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Concepts of a manpower replacement system for a Marine Air Ground Task Force in a deployed/tactical environment

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THESIS

CONCEPTS OF A MANPOWER REPLACEMENT
SYSTEM FOR A MARINE AIR GROUND
TASK FORCE IN A DEPLOYED/TACTICAL ENVIRONMENT

by

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and
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March 1985

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This thesis is designed to illustrate concepts of a manpower replacement system for a Marine Air Ground Task Force in a deployed/tactical environment. In this environment, the G-1 is tasked with the responsibility of coordinating all efforts associated with personnel replacements in an efficient and timely manner. The first part discusses the requirements for such a system. The secound part discusses the requirements of the system, including

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Concepts of a Manpower Replacement System for a Marine Air Ground Task Force in a Deployed/Tactical Environment

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ABSTRACT

This thesis is designed to illustrate concepts of a manpower replacement system for a Marine Air Ground Task Force in a deployed/tactical environment. In this environment, the Administrative Officer (G-1) is tasked with the responsibilities of coordinating all efforts associated with personnel replacements. Presently, there are no systems responsive enough to handle personnel replacements in an efficient manner. The first part illustrates the need for such a system. The second part discusses the requirements for such a system including data elements and data flow requirements of the system. The third part explores several alternative ways of satisfying this requirement. The recommended alternative utilizes distributed processing over packet radio networks linked to the defense data network via gateways or tactical radio links. Applicable attributes of both the DDN and Packet Radio technologies are discussed extensively.

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I. INTRODUCTION

The need for design concepts of manpower replacement information systems, stem from commanders requirements for current, accurate, and specific data on the basis of which sound tactical decisions must be made. "Manpower information is a subset of the whole requirement for information of all types to permit expeditious and economical fulfillment of the mission." [Ref. 1:p.1-1] Processing much of this manpower information in a timely manner is an important consideration when designing a system to handle casualty/replacement, reporting, and projecting. It is an even greater consideration when these replacement efforts must be coordinated between deployed field commanders and stateside mobilization pool commanders.

This study will begin by identifying the information requirements of commanders at each command level. This will includes a distinction between garrison and tactical information requirements, a determination of the necessary data elements and data flow, and a correlation of data into categories based on timeliness, update frequencies, and importance to commanders. Possible alternative means of satisfying these information requirements will then be explored, with an emphasis on communication requirements, data processing requirements, data security requirements, survivability, accessibility of data, and the likeness of garrison and tactical means of operation.

The Joint Uniform Military Pay System/Manpower Management System (JUMPS/MMS) presently provides many of the data elements necessary to accomplish this task. However, the content and timing of this information is a real limitation in providing for effective manpower planning in a

tactical environment. Therefore, the overall objective of this study is to reccmmend design concepts for a system that will satisfy these information requirements.

In the very near future, two new technologies will be available for the Marine Corps that should provide assistance in solving this very perplexing problem. First is the Defense Data Network which should be in place for Marine Corps use by early 1986 and second, the advent of the packet radio technology which should be in place for Marine Corps use by 1988 [Ref. 2]. Additionally, deployable force automated service centers have been fielded to provide increased data processing support to deployed Marine Air Ground Task Forces [Ref. 3:p.45].

II. BACKGROUND

> Throughout history, the outcome of conflict has been determined as much by the collection and proper use of good information to control forces as it has been by the quality and quantity of weaponry [Ref. 4].

The success of a conventional military campaign is heavily dependent upon the ability to get sufficient forces to a particular location at a predetermined time, and the ability to sustain the manning level of those forces once they are in place. The achievement of this objective is a task which has plagued military commanders throughout history, and only now has the will and the technological know how emerged to provide commanders with enough information to achieve this objective.

In medieval times, the pace of battle was slow, and military commanders could expend the time necessary to assimilate defeated enemy forces into their own ranks. This manpower replacement system was simple enough, but it will not suffice in a modern day battlefield environment. The extreme mobility of todays' enemy forces, the destructive capabilities of modern weapons systems, and the high degree of individual specialization makes it virtually impossible for todays' forces to rely on such systems. Modern battlefield commanders must rely on a two way flow of information between themselves and rear echelons in order to obtain required replacements. When they are unable to relay this information, there are no guarantees that they will receive the proper number of personnel possessing the desired skills, training, or qualifications.

In view of the volatility of the modern day battlefield, the Marine Corps began to seriously explore the manpower

information requirements of its battlefield commanders with the ultimate goal of devising feasible alternatives to satisfy them. There was common consensus that

> one of the foremost demands of a Marine Air Ground Task Force (MAGTF) commander, particularly in a tactical environment, is the capability to plan rather than react. He needs information in a meaningful time frame to exercise control over his area of responsibility. He can utilize such information in order to assess his situation, plan the utilization of his manpower resources and project future requirements.

[Ref. 1:p.4-7]

In 1974, the Marine Integrated Personnel System (MIPS) study was conducted to determine the parameters of a system which could possibly satisfy the manpower information needs of battlefield commanders. This study highlighted the fact that the Joint Uniform Military Pay System/Manpower Management System supplied a large percentage of data elements in support of manpower/personnel functions. This study also expressed some concern about the methods of disseminating this information, and the adequacy of its context and timing in support of battlefield commanders.

In spite of these possible shortfalls in the JUMPS/MMS system, the MIPS study concluded that systems to be designed to satisfy tactical manpower information needs would have to be either a simple extension of the JUMPS/MMS system or a totally unique system which interfaced with it. This line of thought was in keeping with the Marine Corps' desire to have a single source of manpower/personnel management information, a single system for information input, and a single set of reporting procedures. This line of thought was explicitly expressed in the HQMC, MIPS Study Directive in the following quotation:

> Manpower information is a subset of the whole requirement for information of all types to permit expeditious and economical fulfillments of the mission. The final

manpower system must be an integrated whole, existing and functioning in both the tactical and non tactical environment without conversion requirements.

[Ref. 5:p.1-2]

The objective of the MIPS study was to provide the Marine Corps with a concept for a single source of data to meet the informational requirements of a MAGTF commander, and provide continuous support to the JUMPS/MMS system. The MIPS study did not provide the Marine Corps with a system configuration but that was not its intent. It did however outline system requirements, user needs, information sources and system performance requirements. It also provided the Marine Corps with a detailed conceptual understanding of what this problem entailed in terms of the complex interactions of manpower/personnel data flow.

It was the purpose of this study to determine a configuration methodology which could be utilized as a guide or stepping stone in the progression towards the achievement of an integrated personnel system [Ref. 5:p.6-18].

Upon the completion of the MIPS study, the Marine Corps began to adapt several of its recommendations, but very little else was done in terms of trying to answer the overall questions of how to provide field commanders with timely access to this single data source once it was developed. Several data collection and processing enhancements were made but these enhancements have fallen far short of improving data timeliness and accessibility.

Force Automated Service Centers(FASC) and Regional Automated Service Centers(RASC) were adopted by the Marine Corps to provide non dedicated Automated Data Processing (ADP) support to supporting establishments and FMF commands. The ADPE-FMF(green machines) devices were also introduced and they were designed primarily to provide commanders down to the battalion/squadron level with organic ADP capabilities. [Ref. 6:p.2-3]

These centers and devices did a great deal to improve the information processing capabilities of FMF commanders in garrison but little tc improve their battlefield processing capabilities. Only the ADPE-FMF devices were deployable and due to their limited processing and storage capacity, their impact on the fulfillment of a deployed commanders' information needs were limited.

In the early 1980s, the Real Time Finance and Manpower Management system (REAL FAMMIS) development team began to analyze the possibilities of a deployable automated information system to support manpower and pay related functions. Their study lead to the development of the Deployed Force Automated Service Centers (DFASC) and these centers are currently being utilized in support of deployed Marine Amphibious Forces. [Ref. 7] They provide a great deal of information processing capacity to a deployed force within the Amphibious Objective Area (AOA) but, they still lack that vital link which ties them into the JUMPS/MMS which has become that single information source recommended in the MIPS study.

All of the improvements made thus far have been in the area of improving the ability of field commanders to process data within the AOA. These improvements are only pieces of the pie, and until real time access is provided to the JUMPS/MMS, the pie will remain incomplete. The system will lack timeliness, and much of the vital data within JUMPS/MMS will remain inaccessible to field commanders. The MIPS study hinted at this fact as early as 1974. This ccncern was best expressed by the following quotation:

> The MAGTF Commander has, in the field, a far more accurate picture of his manpower/personnel situation than may be reflected in the most current reports available from the existing JUMPS/MMS. This is so because, as a personnel event occurs in the field and is reported, the commander acts on the knowledge gained by that event. He does not postpone decisions until the acceptance of data submittal is signaled. He must act on what he

knows to be the real world. In a combat environment, for example, it may be days before JUMPS/MMS can reflect his casualties, while he is immediately required to request suitable replacements [Ref. 1: p. 4-29].

To prevent field commanders from losing a valuable source of information in the decision making process, real time information retrieval and update capabilities must be provided. More analysis must be directed at this piece of the pie. Feasible solutions must be developed and implemented in order for the Marine Corps to achieve its overall objective of developing a system capable of functioning in both the tactical, and non tactical environment without conversion requirements.

A. SCOPE

The Administrative Officers (G-1s) are tasked with the responsibility of providing the data elements necessary to update the JUMPS/MMS, and for coordinating manpower replacement efforts. They are the principal staff assistants in matters pertaining to personnel management, internal organization, operation of the headquarters, and miscellaneous administrative functions not specifically assigned to another general staff member. They also have direct staff responsibility for the following areas:

1. Maintaining adequate strength levels
2. Management of personnel replacement efforts
3. Disciplinary Actions
4. Maintaining law and order
5. Prisoners of war
6. Grave registration
7. Troop morale and personnel services

8. Civilian Employees
9. Interior Management

[Ref. 8: p. 3-23].

This administrative classification puts them at the bottom of the totem pole when it comes to requesting communication, or information system support. Without ample replacements of the proper grade, skills, and training, the battle could be lost through personnel mismanagement and attrition. This brings about a need for a reclassification of those functions associated with the management of personnel replacements and casualties. This reclassification is an almost prerequisite in the development of a systems concept to provide the information necessary to manage these casualty and personnel replacement efforts. [Refs. 9,10]

This study will cover the early concept development stages of an information system directed at satisfying those G-1 information needs which are pertinent to the management of casualties and personnel replacements. Chapter 3 is the mission elements needs statement. It will describe in generalized terms, the mission to be accomplished. Chapter 4 is a requirements statement and it will provide a definitive, written statement of user requirements. Chapter 5 is a feasibility study and it will present the results of the analysis of alternative approaches to satisfying those requirements identified in the requirements statement. The final chapter will provide a summary of this study and recommendations on what actions should follow.

III. MISSION ELEMENT NEED STATEMENT (MENS)

A. MISSION AREA IDENTIFICATION

1. Purpose

This document will describe in general terms, the mission to be accomplished and those element deficiencies preventing or hampering its accomplishment.

2. Mission and Authority

The commander is responsible for the efficient employment of all human and material resources to effectively accomplish assigned missions. The G-1 is the commanders' principle staff assistant in the management of personnel. In conjunction with other responsibilities, the G-1 will be delegated the authority to manage the following specific functional responsibilities which are directly related to the task of manpower replacements:

1. Planning and coordinating functions relative to personnel strength control.
2. Estimating casualties in coordination with the Operations Officer (G-3).
3. Compiling statistical information necessary to keep the commander informed of the strength of the command.

4. Determining replacement requirements, present and anticipated.

5. Planning and coordinating the procurement of replacements.

6. Allocating replacements in accordance with priorities established by the G-3.

7. Supervising the processing and moving of replacements.

8. Recommending the mission, composition, and disposition of replacement units and personnel.

[Ref. 11:p.1-2]

3. Current Environment

Formally the G-1 is tasked with the responsibility of coordinating efforts to insure that there will be an adequate flow of replacement personnel into an organization. Under the current peacetime garrison environment, these coordinating efforts are being performed at Headquarters Marine Corps(HQMC). Personnel are currently assigned to the various units throughout the Marine Corps via Permanent Change of Station(PCS) orders which are issued from there. [Ref. 12]

HQMC currently utilizes information that is retrieved from the Joint Uniform Military Pay System(JUMPS)/Manpower Management System(MMS) to determine the number and mix of replacements that are needed at each command. This information is placed into the system by the various reporting units in the form of unit diary entries. It is the responsibility of the reporting units to insure that this data is both accurate and timely. [Ref. 13:p.1-12]

Current plans call for the G-1s at the various commands to assume these functional responsibilities in the event that their units are deployed. When a command is deployed, HQMC will relinquish the task of coordinating manpower replacement efforts to that command. The G-1s must then set up the proper systems which will enable them to carry out these functions effectively. [Ref. 12]

4. Priority

The priority of having an adequate level of personnel of the proper grades and skills is extremely high. In a highly specialized battlefield environment, it would be extremely difficult for the commander to accomplish assigned missions without it. To sustain these manning levels, it is important that commanders set up systems which will enable them to coordinate their personnel replacement efforts in a timely manner. The priority assigned to this need should be higher than that which is assigned to the highest logistical requirements.

B. DEFICIENCY

1. Scope

When deployed, the G-1s must assume the responsibilities of coordinating all efforts associated with the replacement of personnel. There are currently no sufficient means available for the G-1s to coordinate these efforts with stateside mobilization pools within time frames considered adequate. There are also no systems available to provide the G-1s with enough timely information on which

they must base their decisions. The flow of information from both subordinate commands and stateside mobilization pools is often to untimely and incomplete to be of much use. [Ref. 9]

The task of providing replacement personnel to a deployed command is one which requires a coordination of efforts at all levels of command. The reporting units must input the unit diary entries which make up the Field Master File which is utilized to produce the JUMPS/MMS reports. HQMC utilizes these reports to develop manpower procurement, training and rotation plans. The intermediate level commands will utilize these reports to project their manpower replacement needs. The mobilization pools will utilize these reports to project the number, ranks and skills of individuals that they must ship to each deployed command. As can be seen, the JUMPS/MMS systems is one of their primary means of coordinating their effort. [Ref. 13:p.1-16]

The primary deficiency associated with utilizing the JUMPS/MMS system in this manner is the lack of reliable, survivable means for deployed units to update and query the system in real time. There is a major deficiency in the ability to transmit data to and from the AOA. Deployed reporting units have no timely means of entering unit diary data into the JUMPS/MMS system and their superior intermediate level commands have no means of conducting real time queries of data within the system. This deficiency seriously degrades the effective utilization of the JUMPS/MMS system as a primary tool for planning and coordinating manpower replacement efforts. [Ref. 10]

There are serious limitations on the information processing capabilities of a deployed G-1 staff. These staffs currently receive a number of ad-hoc reports from

their various subordinates commands. They also receive an abundance of untimely but usable MMS reports. In order to process this ever changing information in a timely manner, the G-1 staffs need some form of automated information processing and deficiencies in current capabilities should be reviewed.

There are also deficiencies in the survivability of current systems being utilized by the G-1. Current plans call for all unit diary data from reporting units to be compiled at a deployed force automated service center(DFASC) prior to being sent to a Satellite Data Processing Installation(SDPI). Concentrating all data into a single location while in hostile environments is extremely risky.

2. Jobs to be Accomplished

In order to ensure that there is an adequate supply of personnel on hand to accomplish a given mission, the G-1 staff must properly manage each of the functional responsibilities listed above in Section 1 under mission and authority. There are a number of deficiencies which hamper the G-1s ability to carry out these responsibilities and each will be discussed below:

1. To plan and coordinate functions relative to strength controls, there has to be timely two way flow of information from the Amphibious Objective Area (AOA) to stateside mobilization pools. Currently there are no systems available to provide this information flow within time frames deemed adequate. [Ref. 10]

2. In order to properly estimate casualties, the G-1 needs real time information on the types and numbers of casualties being suffered. He also needs a means of assimilating this information. There are currently serious limitations in the information

provided in casualty reports. These reports do not provide sufficient grade and skill breakdowns of casualties. There are also limitations on the G-1s ability to process this information once he receives it. [Ref. 10]

3. In order to ccmpile valid statistical information on strength levels, the G-1s need a means of tapping the data which is stored in the MMS. The JUMPS/MMS system contains a warehouse of data which could be extremely useful to the them if they could somehow obtain access to it while in a deployed environment.

4. To determine replacement requirements, the G-1s must assimilate information from a number of sources. They must get information from the operations officer on planned military operations. They must also pull information from the JUMPS/MMS system on rotation dates of personnel in the command, casualties being suffered by the command, and the expected reporting dates of replacements enroute. Current systems are available to provide this information to the G-1s in a garrison environment but not in a deployed tactical environment. Even after receiving it, there are still serious limitations on their ability to process it within the AOA utilizing current systems. [Ref. 9]

5. In order to plan and coordinate the procurement of replacements, the G-1s need a means of passing real time data to and from the AOA to stateside mobilization pools. They also need a means of passing real time information to Air Force And Naval Commands who must provide personnel airlift and sealift capabilities. Current sytems are not capable of providing a

real time flow of information to fulfill these needs. [Ref. 9]

6. To enable the G-1s to process and supervise the movement of replacements in an efficient manner, they must be provided information on these replacements prior to their reaching the AOA. This would enable them to preassign these replacements. Current systems do not provide this information flow timely enough to accomplish this function [Ref. 10].

C. EXISTING AND PROGRAMMED CAPABILITIES

1. Current Capabilities

The G-1 is currently provided a number of reports which aid him in the management of manpower replacements. Many of these reports lack adequate grade and skill breakdowns but this deficiency could be easily solved by minor report revisions. Most of these reports are also transmitted by means of courier and this is not always as timely or reliable as need be. [Ref. 10]

The introduction of the Automated Data Processing Equipment for the Fleet Marine Force(ADPE-FMF) devices have also provided a means for the commander at the battalion/squadron level to electronically compile data to be entered into the JUMPS/MMS system. This move has done a great deal to improve the accuracy and timeliness of data stored in this system when units are in garrison stateside locations. Its impact has not been as pronounced on improving the timeliness of these updates when the units are deployed.

2. Programmed Capability

There are current plans to deploy a force automated service center(DFASC) with each major command. These centers will provide the G-1s with a great deal of processing capability not currently available to them. These centers will provide the G-1 with an ability to process much of the information provided to them from subordinate commands, but they will not provide the storage capacity to enable the storage of much of the valuable historical data in the JUMPS/MMS systems. [Ref. 14]

3. Impact

If the status quo is maintained, the G-1 staffs will find themselves in a deployed environment with little or no means of adequately assessing the personnel requirements of their units at a given instant in time. They will lack both processing capabilities and access to pertinent data stores.

If the data transmissions problems are not addressed and solved, the G-1s will not be able to adequately coordinate manpower replacement efforts between themselves and stateside mobilization pools. This coordination is absolutely necessary to insure that replacements are shipped when needed and of the proper grade, skills, and quantities. This coordination is also necessary to ensure that the mobilization pools are properly stocking themselves with an number of personnel of the proper grade and skill mix.

The data in the JUMPS/MMS system is utilized by planners at HQMC to project overall personnel requirements for the Marine Corps. These projected requirements are utilized to determine the manpower procurement and training needs. In order to keep the mobilization pools adequately stocked with a proper mix and number of personnel, these

projections must be based on accurate up to date information. If the data transmission problem remains unchanged, much of the data in the JUMPS/MMS will be outdated and inaccurate. Inaccurate data will only lead to inaccurate projections, which will seriously hamper the Marine Corps' ability to fulfill the personnel needs of its deployed units.

D. CONSTRAINTS

1. Constraints

a. Any data transmissions means employed should utilize standard DCD protocols. The data transmission medium should also be capable of interfacing with data transmission mediums of other services as well.

b. Processing requirements within the AOA will be limited by the processing capabilities of the deployed force automated service centers.

c. Limited emphasis should be placed on satellite data transmission mediums due to the Marine Corps' limited supply of satellite transceivers and limited satellite channel allocations. [Ref. 14]

d. Systems should conform as much as possible to the garrison means of performing tasks.

e. Any system developed must be lightweight, portable, and easily deployed.

f. System must be reliable and survivable. Survivability entails the ability to function after the loss of any single node and the ability of its components to withstand the rugged treatment encountered due to the operating environment.

E. PROJECT MANAGEMENT

1. Steering Group

A steering group is recommended consisting of members from MPI-40, and the C-4 division.

IV. REQUIREMENT STATEMENT (RS)

A. GENERAL

1. Purpose

The purpose of the Requirement Statement (RS) is to present the user requirements for an Automated Information System (AIS) which will provide the G-1 staff with the necessary information for manpower planning while deployed or in a combat environment. Previous studies have been completed which identified the need for such an information system. Several possible solutions are recommended in [Refs. 1,5.] Each of these studies identified information requirements, data sources and possible means of processing this information within the amphibious objective area (AOA). The primary deficiency not addressed in either of these studies was that of providing a survivable, timely means of passing this data from the AOA to stateside central processing centers.

The task of coordinating manpower replacement efforts is one which requires an extensive on going exchange of information between units at various command levels. It is the intent of this analysis to identify the various command levels, their information requirements, and the deficiencies which exist in current systems designed to handle these requirements.

2. Point of Contact

The project manager of this effort is Head, Manpower Systems Integration and Procedures Section (MPI-40). The current functional manager of this project is Major Clark.

B. CURRENT SYSTEM

1. Problem Description

The primary problem to be addressed is the lack of survivable, reliable, timely means of transmitting data between the various commanders who must coordinate manpower replacements efforts. The task of providing manpower replacements is one which requires a coordination of efforts at each and every echelon of command. In order to coordinate these efforts, there must be a continuous flow of information from the basic ground units up to the highest levels of the command structure.

Figure 4.1 is an oversimplified illustration which attempts to break down the coordinating efforts into two classes. Those efforts which are necessary to coordinate long term (automatic) replacement efforts, and those which are necessary to coordinate short term (requested) replacement efforts. As illustrated, the stateside mobilization pool commanders, the G-1s at the various intermediate level commands, and the S-1s at the various reporting units are the primary players in the coordination of efforts to satisfy real time requests for manpower replacements. HQMC will become the additional player in the coordination of long term replacement efforts.

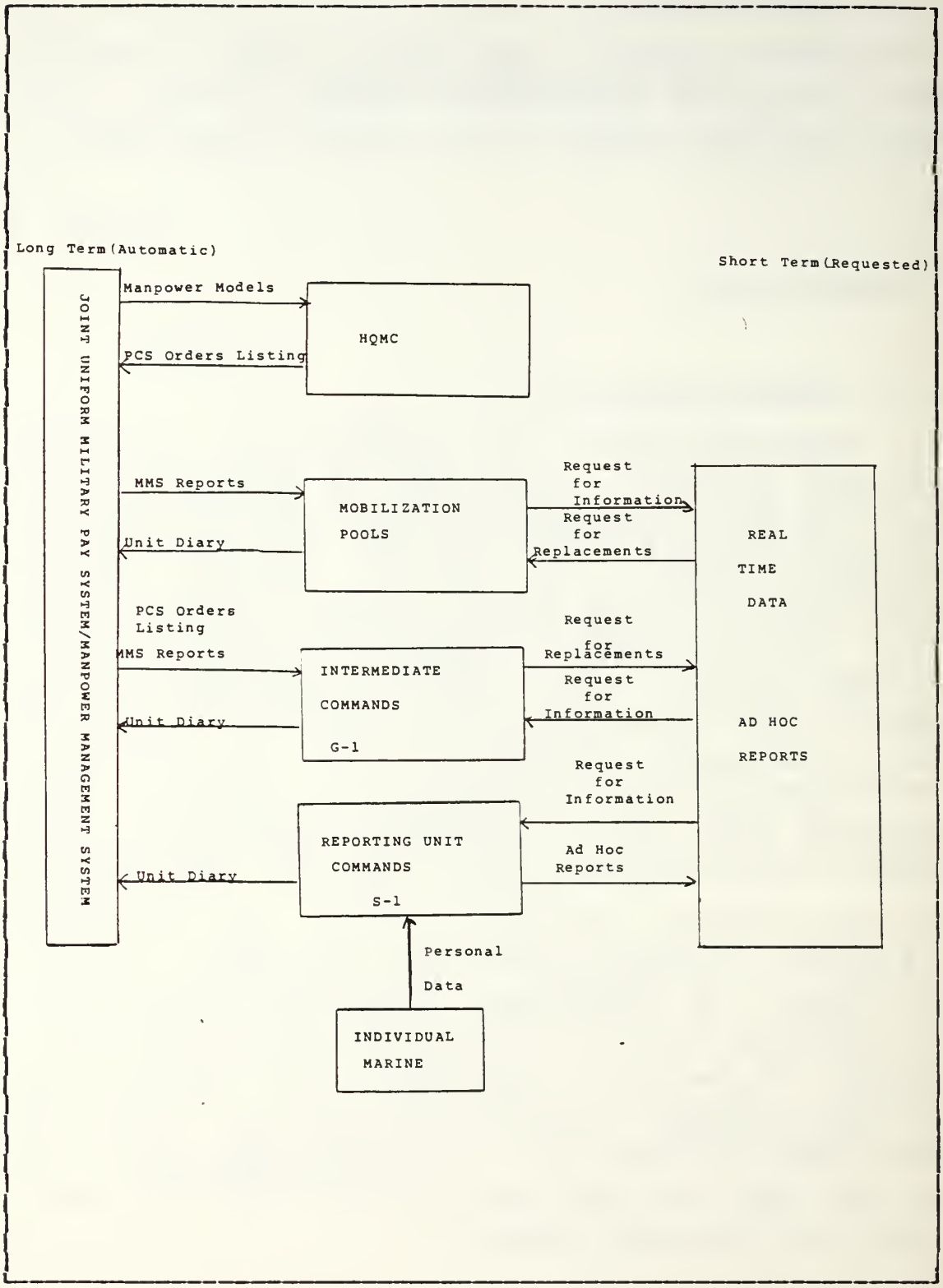

Figure 4.1 Organization Structure Flow Chart

As can be discerned from the illustration, there is a great deal of reliance on information obtained from real time ad-hoc reports in coordinating short term replacement efforts. Efforts to fulfill long term (automatic) replacement requirements rely heavily on data derived from the JUMPS/MMS system.

When units are in garrison, there are few interruptions in the flow of information illustrated in Figure 4.1. However, once the intermediate and reporting units deploy, two primary problems come into focus:

1. How to maintain a two way flow of data into the JUMPS/MMS system. To be of any value, the data in this system must be accurate, timely and accessible. Many items in this system require daily updates. There is also a need for the G-1 to have real time information retrieval capabilities from the system. Currently, there are no systems available which satisfy these information flow requirements for deployed units.

2. How to maintain a real time flow of information from the reporting units to the intermediate level commands, what data is absolutely needed by the intermediate commands, how to process this data and how to duplicate the information flow to stateside locations.

The magnitude of these two problems and their associated subproblems will become more apparent in the walk-through of the data flow diagram in figure 4.2. Some of the associated subproblems and their descriptions are as follows:

1. Under the current garrison system utilizing ADP FMF devices, intermediate level commands are being

bypassed in the unit diary reporting process. Reporting units submit their data to the satellite data process installation via consolidation processes at remote automated service centers or force automated service centers. The intermediate level command receives feedback in the form of MMS Reports but only after the data has been accepted into the JUMPS/MMS system. [Ref. 12]

2. Reports under the current systems provide the G-1 with numbers of casualties but not a by grade and skill breakdown. A grade and skill breakdown is an absolute requirement for an effective manpower replacement system. [Ref. 15]

3. In garrison, Headquarters Marine Corps assumes the responsibility of assigning personnel replacements. In a deployed/combat situation, the field commanders must assume this responsibility. Currently, there is little AIS support to provide the field commanders with a level of information processing necessary to carry out the task of assigning personnel replacements to the proper units. [Ref. 9]

4. In a deployed/combat environment, field commanders receives replacement personnel with limited prior knowledge about their qualifications, grades, or Military Occupational Specialties (MOS). An AIS must provide field commanders with a means of receiving this necessary data on replacements prior to their arrival in the AOA. This will enable commanders to plan assignments, and thereby eliminate potential bottlenecks of personnel waiting to be assigned to specific units. [Ref. 10]

5. Current planned data communications schemes rely heavily on the TYC-5 (Tactical Data Communication Device). These devices have a rather slow data transmission rate (2400 baud) and have proven to be somewhat unreliable. The key fact is that it is no longer being produced [Ref. 3:p.9]. Given the need for data transmission between stateside and deployed forces in the coordination of manpower replacements, alternate data transmission mediums must be explored.

6. Current requirements consume a great deal of the existing deployable data processing and communication resources [Ref. 14]. Due to this fact, an AIS system designed to handle manpower replacement requirements must be one that requires a minimum utilization of these data processing and communication resources, or devises means to improve the efficiency of their utilization.

2. Existing System

There are currently two methods of assigning replacement personnel to individual units. Neither was designed to function totally independent of the other, and when employed in unison, they can become an extremely effective tool.

Their effectiveness is heavily dependent upon the availability of information, and in garrison, this information is plentiful. This is because HQMC assumes the responsibility of assigning personnel to major commands, and the information that is utilized in reaching these assignment decisions is constantly updated. HQMC relies heavily upon the information in the JUMPS/MMS system in determining its personnel assignment policies and it is relatively easy for units in garrison to keep this data updated. The two systems which are currently being utilized are:

1. Automatic Replacement. This is better known as the "push" method. Push refers to the methodology by which replacements are shipped from stateside mobilization pools automatically. The deployed field commander does not have to submit any reports in order to have these replacements shipped to him. Replacements will be shipped based on known and contemplated requirements which are based on historical casualty/replacement statistics which are derived from data within the JUMPS/MMS system. [Ref. 11: p. 4-1]

This system was established as the basic replacement system and it has several merits. Because of the long lead time that is required for recruiting, training, and transporting personnel, future requirements must somehow be determined well in advance. This system is best utilized in projecting these future requirements.

Shortfalls of the current automatic system are realized when the replacements reach the AOA. The field commander will often receive a shipment of replacement personnel without any prior knowledge of their grade/skill breakdowns, or expected dates of arrival [Ref. 9]. Receiving personnel in this manner causes bottlenecks at the field commander's personnel assignment section. If he had prior knowledge of the breakdown of these replacements, he could preassign these individuals to units where their skill are needed. This would eliminate much of the under utilization of human resources which results from having replacements waiting around to be processed. There is also a fit problem associated with this methodology. The field commander may receive the proper number of replacements but these replacements may not be of the proper grade and MOS. This results from the current inability of the system to provide supplemental real time information to stateside manpower pool commanders. [Ref. 10]

2. Requisition Replacements. This is better known as the "pull" method. Under this method, the field commander will notify the stateside mobilization pool commanders of his needs for replacements above those which are being shipped automatically. This method is currently hampered by the fact that the field commanders currently lack adequate systems which provide them with timely, accurate reports from subordinate unit commands which are necessary to make this system work effectively. [Ref. 11: p. 4-2]

When the field commanders are forced to rely on inadequate reporting systems, they must estimate required replacement levels and this will often result in grade, skill, and strength mismatches.

The major deficiencies of current systems lies in their inability to get adequate information to the right people at the right time. The underlying methodologies are logically sound. However, it is their inability to supply the necessary information which is inadequate and that's the basis of this requirements statement.

The data flow diagram in Figure 4.2 is an attempt to graphically illustrate the major functional processes involved in current manpower replacement systems. It graphically displays the processes, the units or organizations responsible for the processes, and the information that goes into and is produced by each process. Units and organizations will be represented by rectangles, processes by circles, data stores by two parallel lines and data elements or structures by arrows. The supporting data dictionary and process descriptions are in appendices A and B.

The first step in determining replacement requirements is a review of the unit personnel status and recording this data. Process 1 "Report Personnel Status" is the step which accomplishes this task for the reporting units.

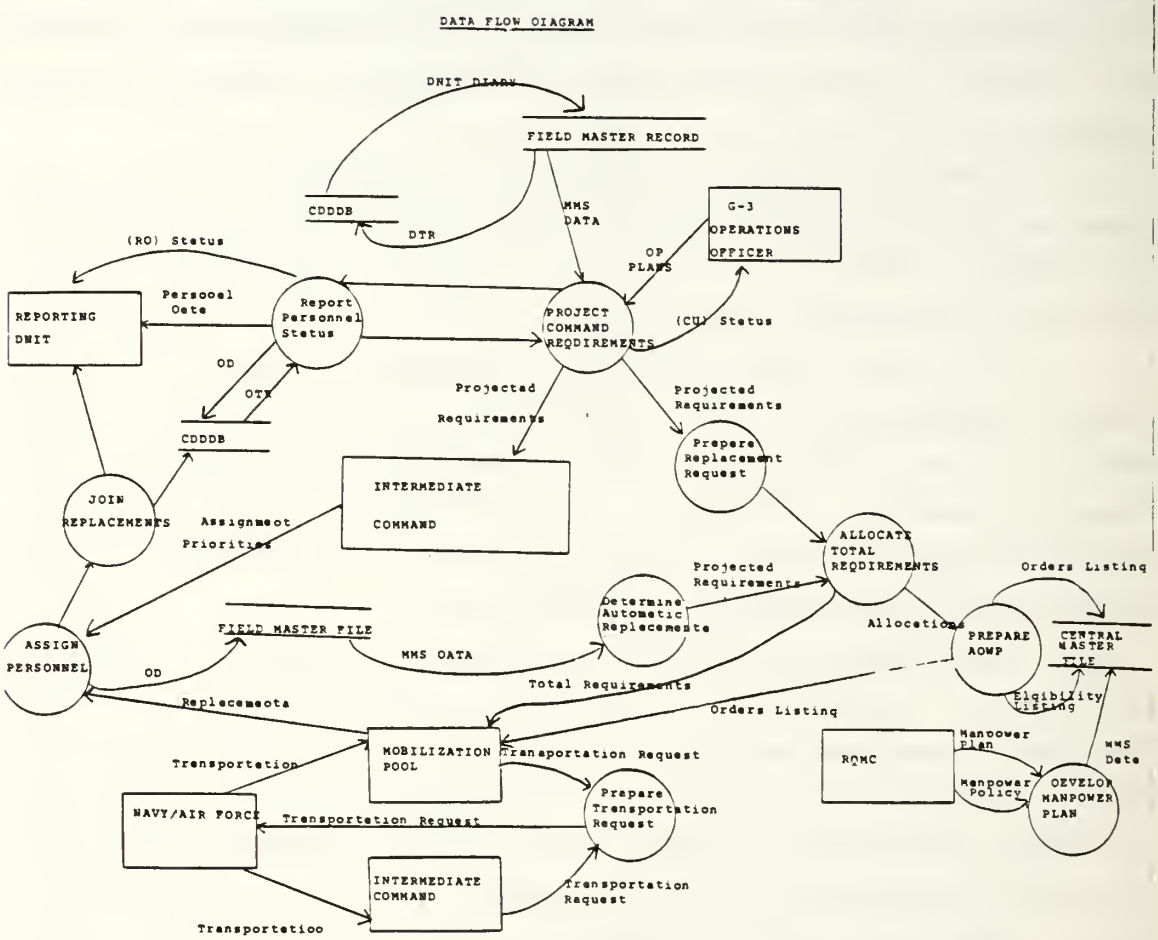

Figure 4.2 Data Flow Diagram

Reporting units currently utilize ADPE-FMF devices (green machines) to store this data on magnetic diskettes. Any changes to an individual' status will be noted with a unit diary entry which will update the Commanders' Unit Diary DataBase(CUDDB), and later be utilized to update data in the field master file.

The reporting units must then send a copy of the updated diskette to the intermediate commanders by means of courier. A similar process will be utilized to satisfy standard and ad-hoc reporting requirements. This form of data transmission is extremely slow and unreliable in a hostile environment.

Once the G-1s at the intermediate level commands receive the various status reports from the reporting units, they will compile this data in conjunction with data retrieved from the MMs and the operations officer. This compiled data will be utilized to project the personnel requirements of the command over a given period of time (process 2).

In a deployed environment, the G-1s currently have little or no access to data stored in the JUMPS/MMS system. They may receive reports but they currently have no real time query capabilities. This deficiency makes it difficult for them to make meaningful projections of their manpower needs [Ref. 9]. They are also hampered by the long turn-around time that is involved in requesting and receiving supporting data from subordinate units due to the slow speeds of courier transmissions. Some voice and teletype transmissions are utilized to speed up this process but these methods require a reentry of data into storage mediums and this is also a time consuming process.

The G-1s utilize the processing facilities of the deployed force automated service centers (DFASC) to process data into desired formats. These same facilities will also

be utilized to compile the unit diary entries from the various reporting units prior to transmitting them to an SDPI where they will be entered into the JUMPS/MMS system via the Field Master File.

This type of data centralization is vulnerable in a hostile environment. It is also not very conducive to the timely flow of information. Data coming into and going out of the AOA must find its way through the DFASC. During peak loads, this type of centralization could create a bottleneck. To make matters worse, there are currently no sufficient, reliable means for the G-1s to transmit this data electronically from the DFASC to the SDPIs. The utilization of a courier transmission medium entails an information turnaround time of days and this is inefficient in situations where a high rate of casualties are being suffered.

Process 3 is the process where the G-1s will combine the latest personnel status data with projected requirements to formulate a replacement requisition to be submitted to the replacement pools. This request for replacements could be inaccurate if a high rate of casualties are being suffered, and the latest status data available to the G-1 is hours old. It is almost impossible for the G-1 to maintain up to the minute personnel status data utilizing current data transmissions mediums between themselves and the reporting units.

The replacement requisition request will be submitted to one of the stateside mobilization pools where it will be combined with a projected requirements listing developed by the mobilization pools. This is process 5. The data utilized to determine automatic replacements (process 4) is obtained from the field master files of the JUMPS/MMS system. As noted earlier, the data within these files is often outdated due to the long lead times that are needed for the data to work its way up from the reporting

units through the various bottlenecks, and delayed transmission mediums. If the mobilization pools are relying on outdated data to make these projections, they will be furnishing replacements to fill needs which may no longer exist.

The allocation for total requirements(process 5) becomes an even riskier task because the mobilization pools are forced to utilize two sources of untimely data. Due to the manual data transmission medium between the deployed commands and the stateside mobilization pools, days may have passed since the reports were originally generated. If the rate of casualties are high, this delay would make it almost impossible for the mobilization pools to adequately satisfy the replacement needs of the deployed units.

There are no deficiencies in the current system in the fulfillment of the requirements for processes 6 and 10. This is true because these processes do not rely on time sensitive information, and much of the information can be retrieved from stateside data stores.

The preparation of transportation request (process 7) is hampered by the lack of sufficient interservice data communications. The same data transmission problems which hamper AOA to stateside communications will also hamper the requirements for interservice data communications. In conjunction with this, there are current problems of interservice operability. [Ref. 9]

In process 8, the G-1s at the intermediate commands must assign replacement personnel to the various reporting units. To make these assignments, the G-1s will rely on information obtained from the manpower pools, the reporting units and the PCS orders listing which is retrieved from the MMS system. If this information is timely, the G-1s can assign replacements prior to their reaching the AOA. This reduces the bottleneck at the personnel holding areas within

the AOA, and results in a more efficient utilization of the human resources. If this information is untimely, the G-1s must obtain much of the necessary unit diary information from the reporting individuals and this can be a slow and costly process.

Process 9 is the beginning of the information cycle. This is the process where the reporting units retrieve much of the information that must be entered into the MMS system from the individuals marines and joins these individuals by making appropriate unit diary entries. It is this data and updates to this data which will travel the complete cycle of the JUMPS/MMS system, and be relied upon so heavily as inputs into the manpower planning process.

The current system does not provide a means of getting this data to an Administrative Control Unit at the SDPI in a timely manner. Due to this fact, the entire accuracy of the data which is the backbone of the MMS system is in jeopardy. The accuracy and effectiveness of decisions which are made based on this untimely data are also in jeopardy.

C. REQUIRED CAPABILITIES

1. Capability Identification

The manpower replacement task requires an AIS which will enable the responsible field commander to compile unit casualty reports, which give him a breakdown of casualties by grade and skills. This AIS support must also provide a means for the field commander to rapidly pass this compiled data back to stateside mobilization pools. Once this data is received by the mobilization pools, the AIS must provide a means for the mobilization pool commander to pass back to

the field commanders a by name, grade and skill breakdown of replacement personnel aboard a departing ship or aircraft.

The desired system must be capable of daily state-side to AOA data transmission. It must also provide enough storage and processing capacity within the AOA to handle the compilation of the necessary casualty and replacement reports.

Due to the nature of casualty and personnel replacement reporting, the system must provide some means of data encryption. The timeliness of casualty/replacement reporting almost dictates that this encryption be on line. If not on line, the system must provide a plan for handling the off line encryption of this data.

The system must be survivable and highly reliable in a hostile environment. It must be flexible enough to support a highly mobile deployed force. Its hardware processing and communications components must be capable of operating off of a generator power supply thereby being tolerant of generator power fluctuations. The hardware components must also be easy to maintain and service.

The flexibility inherent in the system must be of such a nature that it enables the individual field commanders to draw upon data from a variety of sources. The system must somehow support the different management styles of individual commanders and thereby provide them with that information which they deem necessary for making decisions. The information must be in a format suited to their individual management styles.

The communications subsystem must be time responsive, reliable and survivable. The bit error rate of the communication subsystem should be as low as 10 to the eleventh power.

2. Organizational Structure

Figure 4.1 depicts the organizational structure of casualty reporting very well. All request for replacements are initiated at the squadron/battalion level. The intermediate ccmmands will consolidate requests from all subordinate reporting units, and coordinate the fulfillment of these requirements with the mobilization pool commanders. The mobilization pool commanders will provide the necessary replacement personnel to fulfill these requirements, and coordinate the issuance of orders and the procurement of new replacements with HQMC.

3. Interface With Other Systems

The system can actually become a subset of existing systems being designed to support a deployed MAGTF. It should be capable of interfacing with the Defense Data Network (DDN) and with existing AIS systems already in place. The system must enable the commander to interface with the computing facilities at the DFASC from remote job entry sites. There also exist a need for the system to interface with systems supporting operational units. This requirement is necessary for planning manpower buildups to support major operational offensives.

When reviewing the information requirements supporting the management of manpower replacements, one realizes that much of this information also supports the JUMPS/MMS system. Therefore, any enhancements in the availability of information to deployed field commanders must also upgrade the JUMPS/MMS services provided to that commander. This mutual reliance on common data implies that any system designed to support deployed units must interface with the JUMPS/MMS system by means of shared data having standard data elements and structures.

4. Operating Environment

The operating environment is expected to be one which is hostile to any form of electronic computing and communications equipment. The hostilities may be in the form of enemy electronic countermeasures, inclement weather conditions, or component abuse resulting from rugged physical mistreatment.

5. Communications Requirements

Communication support for this system should provide a means of passing data electronically from the ADPE-FMF devices at the squadron/battalion levels to the DFASC which will be utilized by the G-1 at the intermediate command level. It should also provide a communications link to transmit data between units in the AOA and stateside central processing centers.

The required information system may have communication requirements for both voice and data transmissions. The type of data to be transmitted over the communications system will include data to support JUMPS/MMS reporting requirements and data which is necessary to produce the reports listed in Table II.

It is anticipated that much of the required reporting will be on an as needed basis. This makes it almost impossible to accurately project data transmission volumes. The actual volume of data will be a factor of the intensity of the battle and the desired volume of information desired by the individual commanders.

TABLE I

Report MATRIX

"REPORT NAME" MATRIX

UNIT_____

RUC_____

DATE_____

MOS	GRADE 01	02	03	04	05	06	07	Total MOS
2502								
2602								
3402								
0802								
0302								
1302								
Total Grade	____	____	____	____	____	____	____	____

RECOMMENDED REPORTING FORMAT

TABLE II

Data Perishability

DATA REFRESH RATE	REPORTS
Every 6 Hours	Strength of Units Summary Report *Personnel Request Report Personnel Status Report
Every 12 Hours	Personnel Forecast Estimate
Every 24 Hours	Periodic Personnel Reports Replacements Daily Personnel Summary Report Replacement Strength *Personnel Strength Report Personnel Accession Report
Every 48 Hours	Civilian Employee Report
As Required	*Field Casualty Report

* The recommended format for these reports are in Table I.

The current garrison data transmission volumes could be utilized as a floor for projecting war time requirements. According to the MIPS study,

> The current volumes of manpower/personnel reporting averages between two and three reportable events per man per month. This represents approximately 125 Unit Diary entries per day per 1000 men over a 22 day month. An entry is of variable length, averaging approximately 40 characters of identification and entry content: this represents approximately 5000 characters per day [Ref. 1:p.4-24].

It is anticipated that volumes will increase significantly in a wartime environment.

6. Performance Requirements

The system must be capable of producing and transmitting casualty/replacement reports on an as needed basis. The transmission of data between the stateside mobilization pools and the AOA should be handled by the system within a maximum of twenty four hours.

Table II is a modified representation of a list of reports presented in the MIPS concept design report which were deemed essential. As was expressed in this reference, "it will be a Marine Integrated Personnel System responsibility to provide manpower/personnel management elements of information necessary to produce the listed reports." [Ref. 5:p.2-25] No formats were given for some of these reports. Table I is a suggested format for those reports highlighted in Table II. This format could be utilized for simplicity and expediency.

Desired data refresh rates for the reports are listed in Table II [Ref. 5:p.2-25]. In keeping with these guidelines, the same performance criteria shall remain in effect for systems designed to satisfy the previously mentioned requirements.

> Administrative systems requirements do not vary widely from the relative calm of garrison (whether sea based or shore) to the more active environment of combat. Consequently, manpower/personnel and logistics systems, in general, must be capable of easy transition from the garrison to combat, and should be developed or improved with that understanding in mind. It is also apparent that these functions must be supported continually and without regard to the size of the organization. [Ref. 1:p.4-3]

In keeping with this concept, the system must be supportive of the JUMPS/MMS reporting process. "Data collection of the JUMPS/MMS is based on the principle of singular reporting. Whenever practicable an event is reported when and where it occurs to ensure timeliness of reporting." [Ref. 13:p.1-3] This requirement implies that the system should support current garrison methods of direct individual unit reporting in a deployed/combat environment.

7. Requirements for Backup Capability

There exist a need for a backup system to cover the transmission of casualty/replacement reports from the AOA to the stateside mobilization pools in the event that the primary system fails. There also exists a need for a backup processing capability at the DFASC, however, due to the limited number of tactical processing centers, this requirement can be waived. In the event that the FASC is down, the unaggregated reports could be sent to SDPIs and be aggregated there.

V. FEASIBILITY STUDY

A. GENERAL

1. Introduction

The Feasibility Study presents the results of the analysis of alternative approaches to satisfy the user requirements set forth in the requirement statement.

2. Purpose

1. To provide an analysis of broadly defined alternative approaches to satisfying the user requirements set forth in the requirement statement.
2. To identify alternative approaches which are operationally and technically feasible.

3. List of Alternative Approaches

Four alternative approaches to the development of the Manpower Replacement System (MRS) were considered and are presented in this study. It should be noted that the scope of the presentation is limited to a general description of each alternative. Issues concerning design and implementation strategies are not addressed. The descriptions have been limited to the amount of detail deemed necessary to allow for a meaningful determination of technical and operational feasibility.

The following is a list of alternatives addressed by this analysis:

Alternative 1: Distributed Processing, Manual Transmission to Centralized Consolidation and TYC-5 to nearest SDPI.

Alternative 2: Distributed Processing-Manual Transmission to Centralized Consolidation and manual transmission to nearest SDPI.

Alternative 3: Distributed Processing-manual transmission to centralized consolidation and input into Defense Data Network.

Alternative 4: Distributed Processing utilizing Packet Radio Networks, Gatewayed into the Defense Data Network.

4. Contents

This Feasibility Study includes the follcwing information:

1. A description of the alternatives recommended for further analysis.

2. A description of the existing system.

3. A presentation of the life cycle cost estimates for the technically and operationally feasible alternatives.

4. A discussion of the benefits of the technically and operationally feasible alternatives.

5. A discussion of the basis for selecting the preferred alternatives.

5. Problem and User Requirements

See the Mission Element Need Statement(MENS) and the Requirement Statement (RS)for discussion of the problem and user requirements.

6. AIS Guidelines and Constraints

The Deputy Under Secretary of Defense (C3I) mandated the policy on DOD ADP systems and Data networks as illustrated by the following quote:

> All DOD ADP systems and data networks requiring data communications services will be provided long-haul and area communications, interconnectivity, and the capability for interoperability by the DDN. Existing systems being expanded and upgraded, and new ADP systems or data networks will become DDN subscribers. All such systems must be registered in the User Requirements Data Base, request by the Service/Agency for an exception to this policy shall be made to the DUSD(C3I). Request for exceptions for joint interest systems shall be routed to DUSD(C3I) through the JCS [Ref. 16:p.2].

Each field commander must have access to processing resources in order to send/receive, correlate and display time critical personnel data. The architecture of the information system should be designed to support an environment in which backup resources are automatically assigned.

To enhance the survivability of information, it must be redundantly maintained. Decisions on the location of resources to support this function should be accomplished automatically if it is to be timely and efficient.

To decrease overall system complexity, any system design which utilizes distributed data processing (DDP) must possess the attributes of good DDP design. According to [Ref. 17:p.170] a distributed data processing system having good design will possess the following attributes:

1. Overall system complexity is decreased.
2. Interfaces between subsystems are simple and small in number.
3. End user processors are autonomous to a substantial degree.
4. The distributed processors all conform to a common system's interfaces and standards.
5. The distributed processors give the end users powerful facilities for access to data, report generation, and application development.

6. The peripheral processors are easy to use and need no elaborate system skills.

7. The design of data is centrally coordinated, except where data are usable by only one location.

8. Careful attention is paid to data base design, location, and use.

9. Data dictionary control of data in all locations is used.

10. Careful attention is paid to system wide security.

11. An effective balance is designed between what ought to be centralized and what ought to be decentralized.

To support the needs of highly mobile marine fighting units, the system must also be highly portable, capable of rapid flexible deployment and able to dynamically and automatically reconfigure upon gain or loss of nodes.

7. System Title

Upon approval of the Feasibility Study, the title of the system will be Manpower Replacement System(MRS).

B. FEASIBLE ALTERNATIVE

1. Background

It is recommended that the alternative described in this section be developed conceptually and analyzed as an alternative to satisfying the user requirements specified in the MENS. This alternative was selected from among four others. The alternatives that were not selected are described functionally in section 3.

2. Description of Recommended Alternative

a. Concept

Distributed processors utilizing packet radio networks, gatewayed into the DDN will enable the commanders at each command level to access the computer systems of higher commands and the JUMPS/MMS system. This capability will enable the commanders to make real-time queries of data stored within these systems, thereby providing them with much of the manpower data that they may need in projecting manpower replacement needs. The utilization of this type of network will also provide field commanders with the capability of passing real-time data to stateside mobilization pools. This capability will greatly enhance the ability of field commanders and mobilization pool commanders to coordinate their efforts to satisfy real time manpower replacement needs.

A packet radio network is a network consisting of a number of dispersed packet radio units which communicate with each other via broadcast radio utilizing omni directional antennas. Packets of information which may represent commands, inquiries, file transfers, etc., travel through the network hoping from node to node. These packets will be directed through the network based on information contained in their headers and information contained within each node. [Ref. 18:p.5]

The packet radio technology extends the application of packet switching to the domain of broadcast radio. The packet switching aspect affords statistical load averaging, adapting route selection, maximal flow rates, and minimal nodal storage requirements. The broadcast aspects of these radios facilitates simplified topological design, rapid deployment, redundancy, robustness and most of all, mobility. [Ref. 18:p.10]

Figure 5.1 is a delineation of a packet radio network(PRNET). It can be accessed from any packet radio unit (PRU) by connecting a terminal, a host, a gateway or a speech interface unit (SIU) to one of the PRUs. Packet radios connected in this manner will comprise a node. The terminal interface unit (TIU) is an integrated hardware/ software package that supports the necessary host-to-host and terminal specific protocols. Host computers will interface with the network either directly or by means of host interface units (HIU). The speech interface unit supports voice communications by encoding and decoding voice into and from binary bit streams and packetizing the streams for PRNET transmissions. The gateway is utilized to support protocols which allow internet traffic to pass between different networks. [Ref. 18:p.7]

The Defense Data Network (DDN) is a worldwide packet switching network designed to meet the data communications requirements for the Department of Defense. It is a network consisting of several hundred nodes located throughout the world and capable of handling typical data rates of 50,000 bits per second. It utilizes a layered protocol architecture which enables computer systems from different vendors with different operating systems to exchange data. The transmitted data may be in the form of files, programs, or electronic mail. [Ref. 19:p.2]

Figure 5.2 depicts the DDN protocol architecture. A brief description of this architecture will facilitate an understanding of the recommended system. A brief description of each of the protocols as derived from the DDN subscriber manual are as follows:

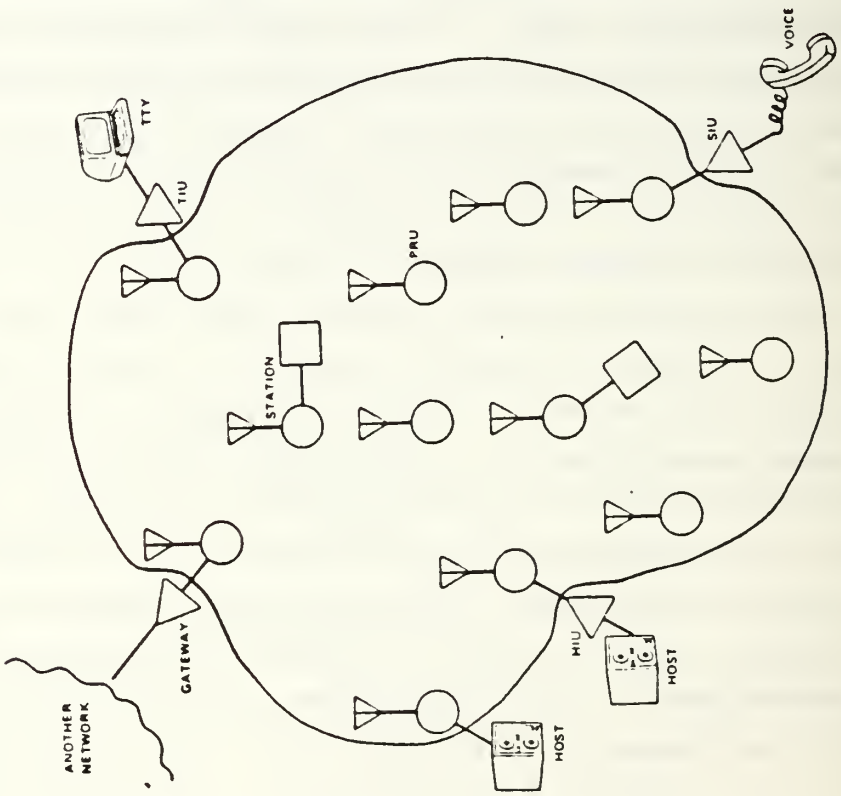

Figure 5.1 Delineation of PRNET

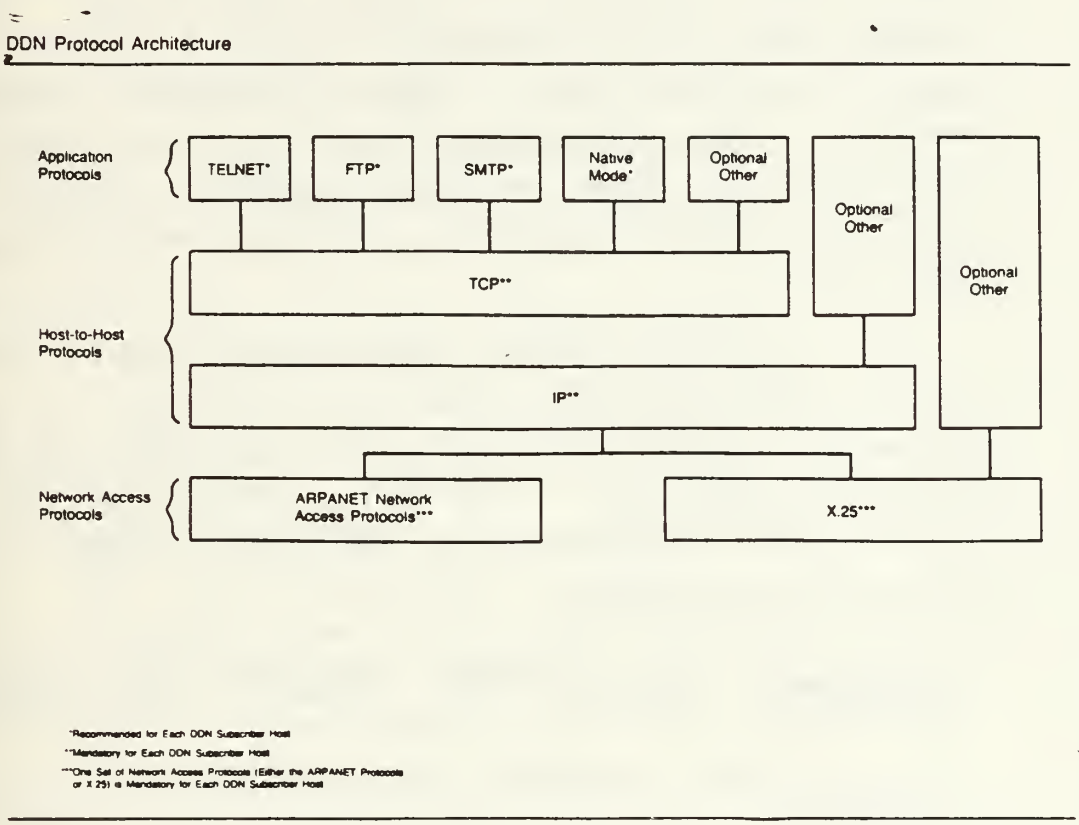

Figure 5.2 DOD Protocol Architecture

1. The ARPANET Telnet protocol, File Transfer Protocol (FTP), and simple mail transfer protocol(SMTP) are the standard DDN application protocols. They support scroll mode terminal-to-host communication, file transfer service, and electronic mail service.

2. The Telnet protocol facilitates communication between host and terminals from different vendors. When TELNET and its supporting protocols are in use, the terminal user has the impression that he or she is logged on to a host that is directly connected to the terminal. The user may execute all tasks normally possible on that host, including logging in, editing, compiling, running application programs, manipulating files, etc.

3. The file transfer protocol enable activities such as file copying, appending, deleting and renaming to be carried out under the direction of a terminal user or application programs. FTP implementation is integrated with a host's file management system to provide the following:

   a) Access to both the source and destination file management systems, in effect, simultaneous log-ins.

   b) Transformation between source and destination file formats.

   c) Directing the transfer of large volumes of data in the presence of potential network failures, and

   d) Providing other file manipulation functions such as directory listings, appending, deleting, etc.

4. The Simple Mail Transfer Protocol supports electronic mail transfer over the DDN. This protocol enables a moderately sized text message to be processed in only a few minutes.

5. The Transmission Control Protocol and its associated internet protocol are the standard DDN transport protocols and they provide the reliable host-to-host peer level ccmmunications necessary to support the application protocols mentioned above.

The reccmmended system design is one which utilizes a hierarchy of packet radio networks within the AOA. These networks will interface with each other and the DDN through gateways. Long haul data communications may be required to establish the tie-ins with the nearest DDN switch. This long haul telecommunications may be provided by line of sight multichannel, microwave radio, tactical satellite or dedicated trunk lines. In order to support the packet switched networks, these long haul communications mediums should have a packet switch overlay.

Figure 5.3 depicts this hierarchy of networks. Each of these networks may be comprised of any number of packet radio nodes. Figure 5.1 which was mentioned earlier would represent only one of the networks exhibited in Figure 5.3. The types of computing devices shown do not necessarily represent those which would be utilized by the Marine Corps. The local area networks (LAN) shown within each packet radio network could actually be another PRNET or a hard wired LAN which is gatewayed into a packet radio network.

The system architecture depicted enables users at a given echelon who require more processing resources or access to data which is not available at their level to access it. This is made possible through the packet radio networks' utilization of standard DOD protocols in conjunction with proper application level software. These standard protocols also enable users at any level to gain access to

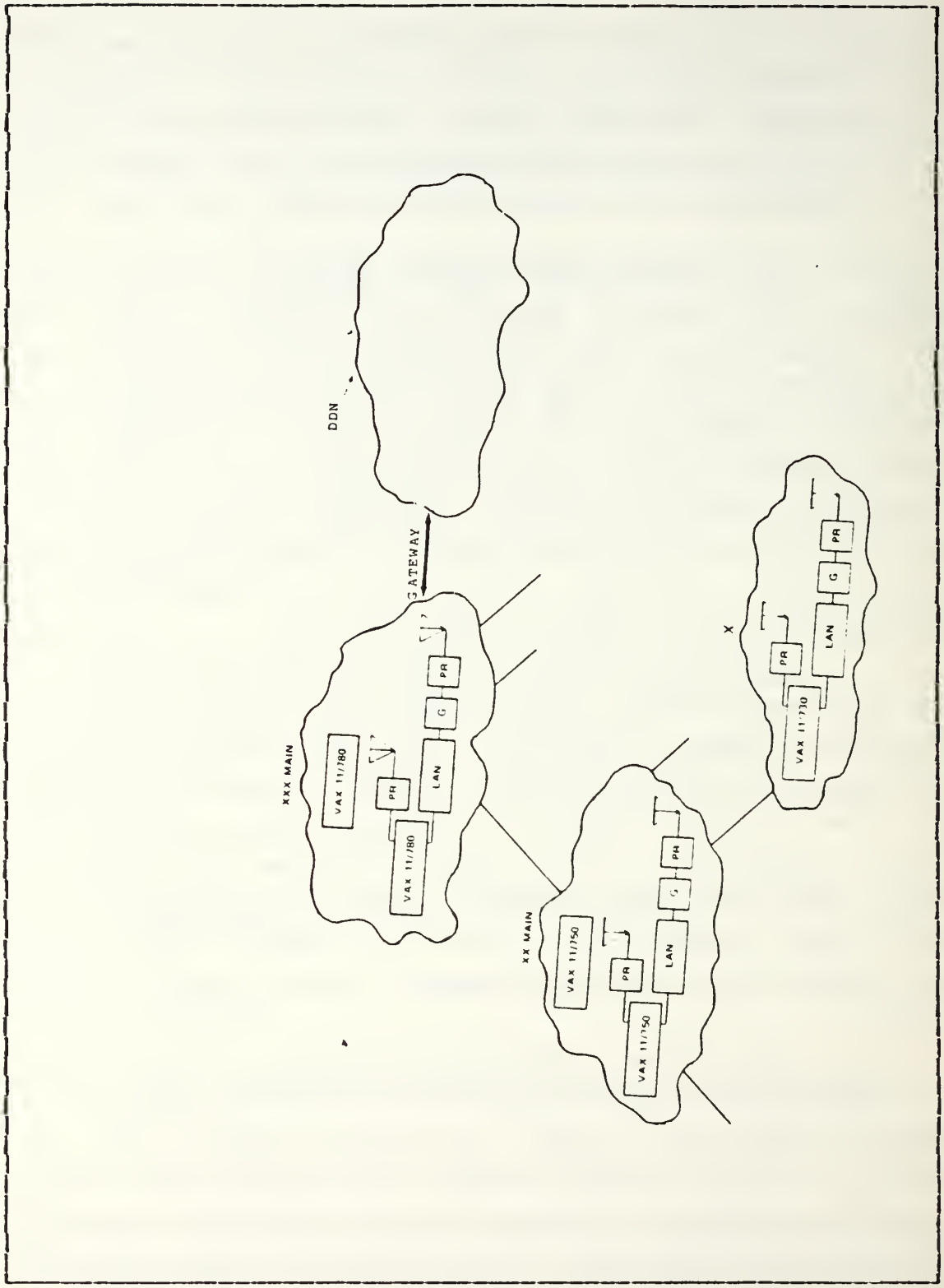

Figure 5.3 Echelons of Computer Processing

the DDN. Once users gain access to the DDN, they may access data stored in the JUMPS/MMS system or pass real time message traffic to and from the AOA to stateside locations.

> The collection of JUMPS/MMS data is based on the principle of singular reporting. Whenever practicable, an event is reported when and where it occurs to ensure timeliness of reporting [Ref. 13:p.1-3].

As can be visualized from the concept presented thus far, field commanders at the various reporting unit levels can easily update data in the JUMPS/MMS system as it occurs. The utilization of packet radio networks gatewayed into the DDN enables commanders at the forward fringes of the battle to update the JUMPS/MMS system as events occur.

When field commanders make unit diary entries, this data is transmitted over the network in the form of packets. These packets are transported through the network on a store-and-forward basis using buffers within each packet radio and a hop transport protocol between them. Forwarded packets are broadcast from a node packet radio and are selectively addressed to a single packet radio which has been identified in the packet header. This iteration of broadcast will take place until the final destination packet radio is reached. Once the destination PR is reached, the packets are passed across an interface to an attached subscriber device or gateway [Ref. 20:p.10].

This configuration utilizing packet radio technology provides for a great deal of system survivability. As data moves through the various echelons of networks, it updates the information in those computer systems addressed to receive it. Once this interactive process is completed, their will be duplicate sets of data scattered throughout the system. This eliminates the possibility of total data destruction when a site is destroyed by enemy forces or goes down due to technical problems.

This same process also enables reporting units to simultaneously update both the data bases at the intermediate level commands and the data in the JUMPS/MMS system. This is made possible by the ability to place multiple addresses on messages that are to be sent over the networks.

The reliability of the system is greatly enhanced by the automatic management aspects of it. These management facilities include procedures for acknowledgement, error checking, initialization, routing, access control, and flow control. Acknowledgements are required on a hop-by-hop basis along the route. Each time an acknowledgement is not received for a packet, the sending packet radio retransmits the packet. Error checking is accomplished by a 32 bit cyclic redundancy checksum. Initialization includes the addition or deletion of individual nodes and this is automatic. Routing control is accomplished by the utilization of special status reporting packets which frequently report the condition of all packet radios and links. Data retrieved from the status reporting packets are collected by the control stations, (see Figure 5.1), and they form the basis for real time routing decisions. This process also enables units to be extremely mobile. If a connection from a mobile user to a repeater deteriorates, the connectivity of the mobile users packet radio unit is transferred to another repeater and this process is transparent to the user. Figure 5.4 is a presentation of the packet format which makes this management process possible. [Ref. 20:p.11]

This system configuration also provides the required simplicity and ease of deployment. All users on a given network access a single radio channel on the same frequency with the same spread spectrum, pseudonoisecode. Access to the channel is controlled through protocols, called carrier-sense-multiple-access to minimize packet

collision. System resources are allocated on the basis of the dynamic demands of users and this aspect facilitates the efficient utilization of resources. [Ref. 18:p.10]

The broadcast features of the packet radio network, sharing a single channel, and utilizing omni directional antennas, greatly simplifies the topological design which would be difficult utilizing hard wire, or line of sight communications means. Each node needs only to remain in contact with one other node but preferably two. This aspect greatly expands the geographical separation that can exist between fighting units and rear command post. This also allows for rapid deployment because no wires are needed and the network can be expanded or retracted automatically. As more units move ashore, they simply turn on there packet radio unit, and allow sufficient time for the local radio on packets to notify the other packet radio units and mini stations within the network, of their location in terms of neighboring packet radio units. [Ref. 18:p.13]

The packet radio network and the DDN will facilitate the ability of deployed units to transmit data within the AOA and to units outside the AOA. "The transmit time of packets through a packet radio network is typically a fraction of a second." [Ref. 18:p.12] This data transmission speed should do a great deal to improve the ability to get real time data to the commanders who need it for decision making. The green machines, deployable force automated service centers, and stateside computer systems are currently providing required processing capabilities. This network configuration is only an attempt to enable field commanders to utilize these facilities in very much the same manner as they do while in garrison.

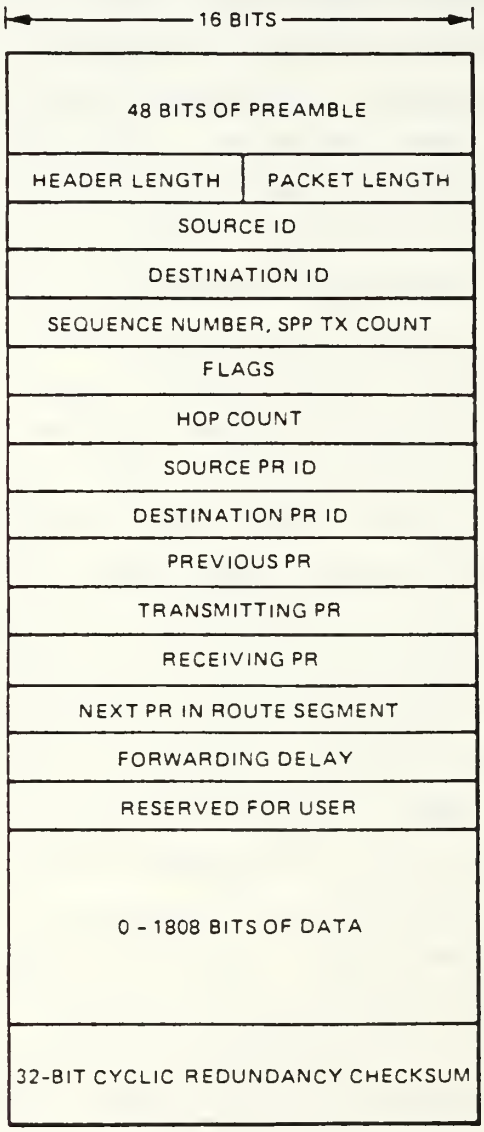

Figure 5.4 Packet Format

3. Inputs

The inputs and outputs for all alternatives are the same and a detailed description is provided in chapter 4, the Requirement Statement. The data flow diagram in the RS also provides a detailed picture of the inputs and outputs of the system.

4. Software

The software required to support this alternative consists of the following:

1. Interactive data screens for accepting user processing request and input parameters for displaying the results of interactive processing, and for user entry of casualty rates, MIA rates, POW rates, and MOS/Grade stratification data.
2. Message formatting programs to generate electronic and hard copy messages.
3. File maintenance and interface programs to build the various files and provide the requisite outputs in formats acceptable to the existing manpower planning processes/model.
4. Programs coupled with the data communications system to provide hierarchical security control mechanisms.
5. AALPS software to be utilized in the preparation of airborne transportation request. [Ref. 1:p. 3-3]
6. Application level software will also be required.

5. Equipment

To support a Marine Amphibious Brigade, the following equipment is required:

Equipment Type	Capacity	Quantity
Terminal Interface Unit	N/A	2
Packet Radio	N/A	20
Gateways	N/A	4
Mini Stations	N/A	4
Speech Interface Units	N/A	3
Host Interface Units	N/A	2

6. Cost Estimate Recapitulation

It is estimated that it would cost approximately $1,820,000 to outfit a brigade size unit with this system. It is not the intent of this study to present detailed costing data in a format which would lead to a determination of the economic feasibility of the recommended alternative. The data presented below is a breakdown of the initial cost of the system. A more explicit cost breakdown would be provided in an economic analysis of this system and such an analysis in beyond the scope of this paper. The following cost data is presented in thousands of dollars:

[Ref. 21]

Equipment Type	Quantity	Unit Cost	Total Cost
Terminal Interface Units	2	14	28
Packet Radio	20	75	1500
Gateways	4	17	68
Mini Stations	6	19	116
Speech Interface Units	3	6	18
Host Interface Units	2	45	90
Total Cost			1820

C. OTHER ALTERNATIVES

1. Purpose

This section describes the alternatives to satisfy the user requirements specified in the manpower replacement system requirement statement that were analyzed but not recommended for further conceptual development and analysis.

2. Existing System

a. Concept

The existing system utilizes distributed processors (ADPE-FMF Devices) at the reporting units to store unit diary data and unit reporting data on floppy diskettes. When the unit diary is entered, the ADPE-FMF device and printer, will create a floppy diskette, create a properly formatted paper printout of the unit diary and update the commanders unit diary data base (CUDDB). The reporting unit commander will sign the printed unit diary and other unit

reports and have them hand delivered with the floppy diskettes to the deployable force automated service centers (DFASC). (See Figure 5.5) [Ref. 6:p.A-22]

The DFASC will be located at the intermediate command level. When the diskettes from the reporting units have all been received, they will be consolidated on magnetic tape. This consolidation process will also update the intermediate-level commander's data base and produce summarized printed reports. The magnetic tape will be transmitted by means of the TYC-5 to stateside locations or to one of the SDPI's. The SDPI's will receipt for the magnetic tape and pass it on to an administrative control unit (ACU) where it will be checked for format errors, consecutive unit diary numbers, etc. Once it has been checked, it is passed on to a control point at the SDPI for further processing and transmission to the Marine Corps Central Data Processing ACtivity where it is entered into the JUMPS/MMS system.

The CUDDB is reconciled against the JUMPS/MMS Field Master File at the supporting SDPI on a monthly basis. The reconciled CUDDB will be returned to deployed units by mail or courier.

The coordination of replacement efforts between deployed units and stateside mobilization pools is accomplished by means of naval messages or request delivered by courier or mail.

b. Inputs and Outputs

The system inputs will be the same as for the recommended alternative. Due to the lack of interactive data exchange with remote computer systems, more reports will have to be in the form of paper printouts.

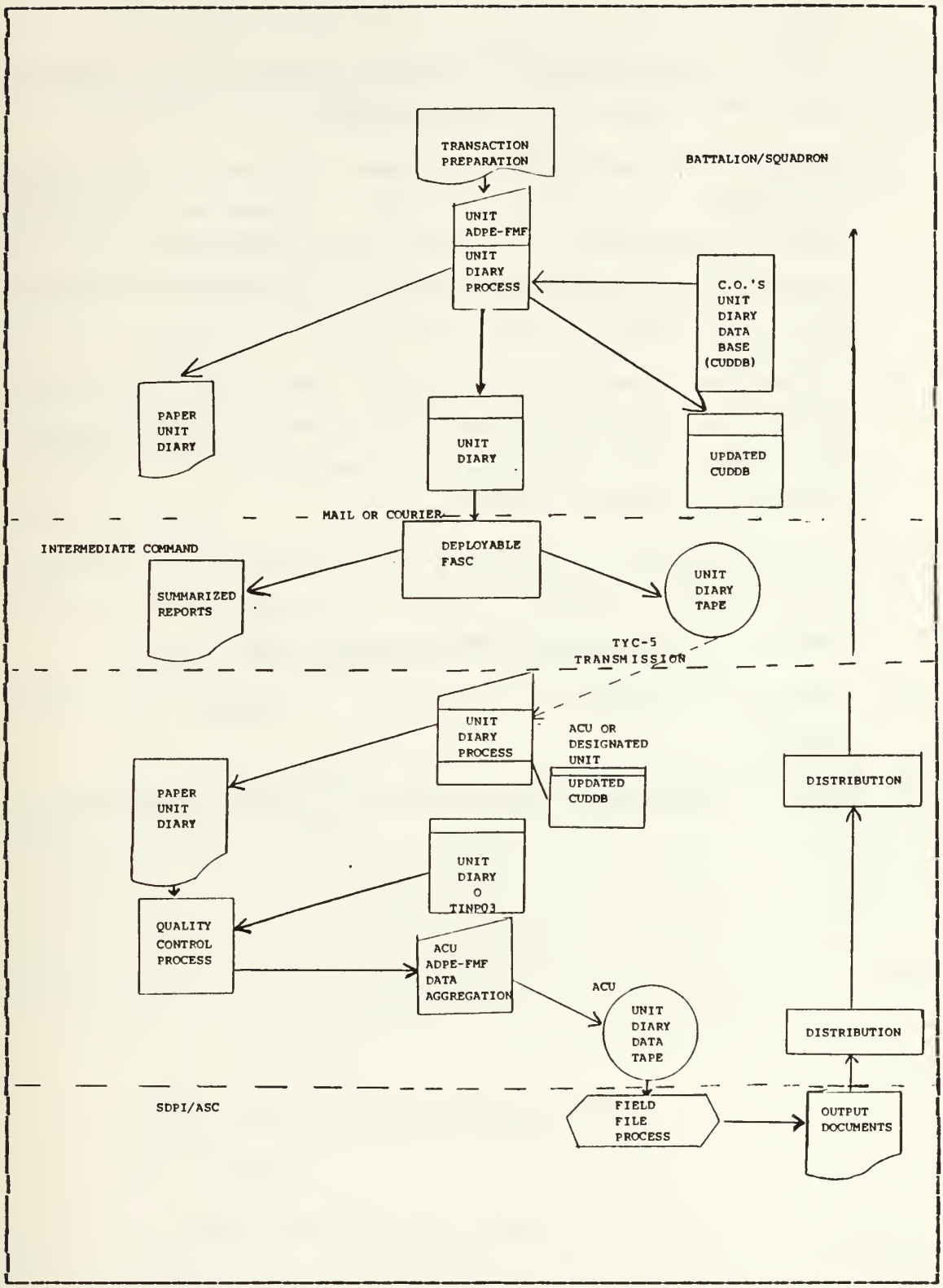

Figure 5.5 Deployed Unit Diary Process

c. Software

The application software required to support this alternative consist of the following:

1. Interactive data entry screens for accepting user processing request and input parameters to the ADPE-FMF devices, for displaying the results of interactive processing, and for user entry of casualty, MIA, and POW rate data.

2. Projection models for applying user-specified casualty, MIA, and POW rates to the required replacement data base to obtain the summarized by grade/mos replacement request matrix.

3. File maintenance programs to maintain the casualty rate tables, summary on hand strength data base and summary required replacements data base.

4. Extract and reporting programs to generate hard copy outputs.

5. Class I programs to facilitate unit diary reporting.

d. Equipment

The following equipment is required to support a MAB utilizing this alternative:

Equipment Type	Quantity
IBM 4341 Processor	2
IBM 3350 Disk Units	6
IBM 3420 Magnetic Tape Drive	8
IBM 3270 Console	2
TYC - 5	1
ADPE-FMF Devices	28

[Ref. 6:p.m-4].

3. Second Nonrecommended Alternative

a. Concept

Alternative 2 is an exact duplicate of the existing system except, for manual data transmissions from the DFASC within the AOA, to the nearest SDPI, or stateside mobilization pool. All inputs, outputs, software, and hardware will be the same as that which is used by existing system except for the TYC-5 hardware component. This component will not be utilized by this alternative system.

4. Third Nonrecommended Alternative

a. Concept

Alternative 3 is very similar to the existing system except, for the methods by which data is transmitted from the DFASC within the AOA, to an SDPI or stateside

location. Once data has been consolidated at the DFASC, it will be broken down into packets and transmitted over the DDN. These packets will then be channeled through the DDN over a multitude of routes until they reach their final destination where they will be reassembled and passed on the addressee.

The method of tying the DFASC into the DDN will be dependent upon a number of controllable and uncontrollable factors. If the DFASC is on friendly terrain, their exist the possibility of obtaining a lease line which would enable the DFASC to access a terminal access controller (TAC) or minitac via a modem [Ref. 22]. This same concept could be applied if there are friendly, usable, telephone lease line facilities within range of a tactical radio shot. The lease line could be linked to the radio unit located on friendly terrain, and the DFASC could be linked to the radio unit at the other end of the shot. The type of radio to be used, will be dependent upon the distance to be covered, atmospheric conditions, terrain, etc. The final decision would have to be made by the commander on the spot. A tactical satellite shot could also be utilized employing the same concept. This is not a recommended method but it could be utilized in those situations when other alternatives are infeasible.

The recommended method of tying the DFASC into the DDN is by means of an interswitch trunk circuit. A circuit of this type would require a host interface unit (HIU) at the DFASC but it would greatly enhance data transmission rates, network features available, and the flexibility of the types of peripheral equipment which could be supported. For more detail on the methods of obtaining these services, their capabilities, and lead time for implementation, see [Refs. 23,24.]

5. Software

The software to support this option is the same as that which is utilized in the existing system.

6. Equipment

The possible additional equipment components are as follows:

Equipment Type	Capacity	Quantity
Lease line	N/A	1
Modem	1600	1
Host Interface Unit	N/A	1
Gateway	N/A	1
*Tactical Radio	N/A	4
Interswitch Trunk Circuit	N/A	1

*The type of tactical radio used will be dependent upon many factors and the choice will have to be made by the commander on the spot. Four radios are recommended. This provides for additional backup at each location.

D. FEASIBILITY DETERMINATION

1. Purpose of Section

This section presents the results of the analysis of each of the four system concepts described in sections II and III. The objective of this analysis is to determine those alternatives which both satisfy the user requirements, and are capable of being implemented. The feasibility of each alternative will be based on technical and operational considerations.

2. Technical Feasibility

The issues to be examined for technical feasibility include the capabilities provided by the proposed hardware and software. The following specific technical feasibility issues are pertinent to this analysis:

a. Hardware Capability

The proposed hardware configuration for an alternative must exhibit the following characteristics for the alternative to be considered feasible.

1. The hardware configuration must provide field commanders with access to sufficient memory and processing capacity to process the replacement and casualty projection models.
2. The hardware configuration must provide data transmission speed capable of ensuring that the data refresh rates for those reports identified in Table II of the requirement statement, are being supported.

3. The hardware configuration must be survivable. No single component should be critical enough to shut down the entire system. Components must also be capable of surviving rugged treatment.

4. Hardware components must be capable of operating off of a generator power supply and be tolerant of power fluctuations.

5. The hardware configuration must have a means of expansion to support the manpower replacement requirements for flexibility.

6. The hardware components must be deployable.

7. The hardware configuration must include only standard production equipment, and the overall configuration must have a demonstrated history of successful operation.

b. Software Capability

The proposed system and support software for each alternative must satisfy the following software criteria for that alternative to be considered technically feasible.

1. Provide programming languages and/or general purpose software that can support the manpower replacement system requirement for a projection model.

2. Support files and file access methods that are consistent with the existing manpower systems to which MRS interface.

3. Provide adequate system response time and throughput to satisfy the MRS requirements for responsiveness.

4. Software products must be well tested and available from reputable vendors with a history of providing quality software products.

3. Operational Feasibility

The following issues were examined to determine the operational feasibility of each alternative:

1. Does the alternative satisfy the functional requirements defined in the MRS requirements statement.
2. Is the alternative capable of being supported without adversely affecting the existing organizational structure, and mode of operations.
3. Can the alternative be supported by existing staff.

Table 2

'Summary of Feasibility Analysis'

Feasibility Issue	ALTERNATIVES 1	2	3	4
TECHNICAL FEASIBILITY				
HARDWARE				
Access to memory processing	YES	YES	YES	YES
Data Transmission Speed	NO	NO	YES	YES
Survivability	YES	YES	YES	YES
Tolerant to power Fluctuations	YES	YES	YES	YES
Expandable	NO	YES	YES	YES
Deployable	YES	YES	YES	YES
Standard Production Equipment	NO	YES	YES	YES
SOFTWARE				
Support Projection Model	YES	YES	YES	YES
Support File Access	NO	NO	YES	YES
Adequate Response Time	NO	NO	YES	YES
Software Vendor History	YES	YES	YES	YES
OPERATIONAL FEASIBILITY				
Satisfy Functional Requirements	NO	NO	YES	YES
Supported by Existing Staff	YES	YES	YES	YES
Supported by organizational structure	YES	YES	YES	YES

4. Analysis of Alternatives

To determine the feasible alternatives, each alternative was examined against the technical and operational issues defined above. An alternative was judged infeasible if it failed any of the listed issues. The results of these comparisons are shown in Table 2.

Alternative 1: Distributed Processing, Manual Transmission to Centralized Consolidation and TYC-5 to nearest SDPI.

This alternative was deemed infeasible because it failed to satisfy all of the technical and operational issues considered. The hardware configuration consist of a TYC-5 data transmitter which is no longer in production and has an unreliable track record. This alternative also failed to meet the requirements for expandability. The TYC-5 has a data tranmission rate on only 2400 baud and this is too slow to handle projected logistical and administrative data transmission requirements [Ref. 14].

Alternative 2: Distributed Processing, Manual Transmission to Centralized Consolidation and Manual Transmission to nearest SDPI.

This alternative was deemed infeasible because it failed to satisfy the technical requirement for data transmission speeds. All data going out or coming into the AOA would be transmitted manually. This manual form of data transmission could result in information turnaround times of several days. This alternative also fails to provide field commanders with real time access to the JUMPS/MMS files.

Alternative 3: Distributed Processing, Manual Transmission to Centralized Consolidation and Input into Defense Data Network.

This alternative was deemed feasible because it meets all of the operational and technical requirements. It was not recommended because of the following reasons:

1. The utilization of messenger data transmission means within hostile environments is not very reliable or timely. If there is a great deal of distance between reporting units and rear commands headquarters, it could take hours or even days to manually transmit this data. Once the data is delivered, additional delays could result if the diskettes are damaged or contain errors. A misfortune of this type could require the entire cycle to be repeated.

2. Reporting unit commanders will still have no means of accessing data within the JUMPS/MMS, or the computer resources of the DFASC. They would have to submit requests to the DFASC and wait until the results could be delivered in the form of printouts, or diskettes. If the distance between the reporting units and the DFASC is great, this could result in substantial delays.

3. The utilization of messengers to transmit data is not very supportive of highly mobile forces. If it takes a messenger several hours to travel from the DFASC to reporting units locations, there exists the possibility that the reporting units will change locations while the messenger is enroute.

4. A great deal of human resources could be utilized transmitting data to and from rear commands and to reporting units. These resources could be better utilized elsewhere.

Alternative 4: Distributed Processing, Packet Radio Networks Gatewayed into the DDN.

This alternative satisfies all the technical and operational issues considered. The proposed hardware and software is in existence and has been tested [Ref. 25]. The hardware configuration has the requisite survivability, expandability and deployability. The software includes the support necessary to address the MRS file management and projection model requirements. This alternative also satisfies all the functional requirements of the user without adverse effects on the current organizational structure or mode of operation.

E. BENEFITS OF RECOMMENDED ALTERNATIVE

The following is a list of direct and indirect beneficial effects that the recommended alternative may have on the mission effectiveness of the USMC if it is implemented:

1. **Advanced Survivable, Distributed Communication System.** The use of broadcast radios enables a dispersion of nodes. The range of this nodal dispersion is dependent on the range of radio signals. Given that each packet radio need be in contact with only two other radios, the overall range of the network becomes a factor of the number of packet radios employed. This dispersion enhances the survivability.

2. **Support Highly Mobile Users.** The broadcast aspects of the packet radios in conjunction with their use of omnidirectional antennas, allows users to move as rapidly and as often as they wish. The only restriction on their movement is the range of the radio

signals themselves. The attached processors will update the required routing data and submit this data for distribution over the network via local-radio-on-packets. (LROP)

3. **Dynamic (automatic) Reconfiguration.** Each packet radio submits local radio on packets periodically to two additional radios which are only one hop away. The neighboring radios monitor the quality of these LROPs and automatically broadcast this data throughout the network via a series of hops. If the signal quality is poor or non existent, each packet radio in the network will receive this data and reconfigure its routing algorithms accordingly.

4. **Effective Utilization of Communication Resources.** Data transmissions utilize almost ten times as less of a channel spectrum as voice communications. Instead of having ten dedicated voice circuits, we can utilize a single data link to pass an equivalent amount of information. This will reduce the need for a multitude of dedicated underutilized communication links.

5. **Enable Network to be Capitalized on Existing Communication Equipment.** The packet radio concept utilizes current tactical radios. The device which enables dynamic routing is a small processor (micro computer unit) which attaches to current radio devices.

6. **Utilizes Standard DOD Protocols.** This aspect enables the network to support a multitude of incompatible processors. It also enables us to gateway the tactical networks into the DDN.

7. **Reduces capability of mapping command structure.** Enemy forces monitoring electronic emissions will have difficulty mapping out the command structure. Given that we can do away with the multitude of dedicated nets, there is no longer that trail of electronic emission leading directly to the command post.

8. **Supports the Concept of Cellular Command Post.** Supports the concept of the cellular command post, that attempts to ensure the survivability of a command center in a tactical conventional or nuclear environment through distribution and replications of the functional areas presently consolidated into one Combat Operation Center (COC). **[Ref. 26:p.6]**

F. SELECTION PROCESS

1. Purpose

The purpose of this section is to present the basis for selecting the recommended alternative.

2. The Process

The selection of the recommended alternative was based on the systems demonstration of the following attributes:

1. System ease of deployment.
2. Systems' ability to support a garrison and tactical mode of operation that appeared almost identical to the user.
3. Ability to meet the mandates of the Deputy Under Secretary of Defense (C3I) for DDN utilization.

4. System Survivability

5. System Flexibility in support of mobile deployed fighting forces.

6. The ability of the system to meet the operational and technical feasibility criteria.

VI. SUMMARY/CONCLUSION

This study was an attempt to develop a design concept, for an automated information system directed at satisfying the manpower/personnel information needs, of those commanders who must manage the task of providing personnel replacements for deployed Marine Air Ground Task Forces. This need was brought into focus in the mission element needs statement (MENS). This statement also provided a broad overview, of the impact, that the absence of such a system would have on the ability of deployed forces to carry out their assigned missions.

After the needs for the system had been established, user requirements had to be identified. The requirements statement was utilized to express these requirements in a manner which would aid designers in developing system concepts to satisfy them. This statement identified the types of information needed, their source, their required data refresh rates, the required processes, the outputs of the processes, and the users of this information. It also identified the types of interfaces that would have to exist between new systems, designed to satisfy these user requirements, and existing systems, designed to meet other manpower management information needs.

After user requirements were identified and expressed in terms usable by systems designers, several design concepts were developed. Those design concepts were presented in the feasibility study. This study presented a broad description of each proposed system and analyzed those alternatives in terms of their ability to satisfy the identified user requirements. Each alternative was viewed in terms of its operational and technological feasibility. Only one alter-

native satisfied both grading criteria, and it is recommended that this alternative be reviewed for further study and analysis.

The Marine Corps expressed a desire to have a single source of manpower/personnel management information, a single system for input of information concerning marines and a single set of consistent personnel reporting procedures, almost ten years ago [Ref. 1:p.1-1]. The introduction of the Defense Data Network, Packet Radio Technology and deployable processing devices have now made this desire a realistic possibility. It is now up to military planners at the highest levels to explore these technological breakthroughs, and devise methods of utilizing them to satisfy not only the requirements identified in this study, but other user requirements as well.

If this study does nothing more than raise the curiosity of military planners to review the capabilities and potential uses of packet radio networks in a battlefield environment, it will have served its purpose. The Marine Corps is not accustomed to operating in environments which are conducive to the establishment of hardwired, static data networks. By the time a MAGTF secures enough real estate to set up such static networks, more than likely, it will be time to move on and relinquish that real estate to larger army forces. It is therefore necessary for us to begin reviewing data networking methods that are complimentary to our method of operation. It is too late for us to do away with our tactical computer resources, and too ineffective for us to continue utilizing them as stand alone entities.

APPENDIX A

DATA DICTIONARY

1. **AVAILABILITY/DUTY STATUS: Field Length XXXXXX.**

A code that indicates the marine's availability for duty on a real time basis. There are five categories which define this element. The categories are: strength category, Combat casualties, type current duty, duty status, and availability. Each category has one character and the corresponding reference is the Manpower Management System Codes Manual (MMSCODESMAN) MCO P1080.20.

2. **AUTHORIZING-AUTHORITY: Field Length XXXXXX**

This data element denotes the reporting unit code of the organization authorized to issue the PCS orders.

3. **CATEGORY(COMPONENT/CLASS): Field Length X**

The is a one character code that identifies an individual as Regular, Retired or member of other service. The one character code is referenced in MCO P1080.20.

4. **COMMAND-NAME: Field Length XXXXXXXXXXXXXX**

This is the name of the command in which a replacement is actually assigned. The command names are referenced in MCO P1080.20.

5. **COMMAND-REPORTING-UNIT-CODE: Field Length XXXXX**

This is the reporting unit that is the senior command under a monitored Command Code.

6. **DATE-CURRENT-TOUR-BEGAN: Field Length XXXXXX**

This denotes the date the individual commences the current tour at the present Monitored Command Code (MCC). The format is YYMMDD.

7. **DATE OF ARRIVAL: Field Length XXXXXX**

This data element denotes the date in which the assigned replacements actually arrive at the designated reporting unit.

8. **DATE-OF-DEPARTURE: Field Length XXXXXX**

This data element denotes the actual date in which an individual departs a given command in route to a new duty station.

9. **DAILY-AVERAGE-CASUALTIES: Field Length XXXXX**

This data element is used to denote the average number of casualties incurred by a command on a given day.

10. **DAILY-AVERAGE-MISSING-IN-ACTIONS: Field Length XXXXX**

This data element is used to denote the average number of personnel designated as missing in action.

11. **DAILY-UNIT-GAINS: Field Length XXXXXX**

This data element denotes the gains incurred by a reporting unit on a daily basis.

12. **DAILY-UNIT-LOSSES: Field Length XXXXXX**

This element denotes the losses incurred by a reporting unit on a daily basis. This information is used in assessing the needed replacements for a particular reporting unit. It includes losses due to casualties, MIAs, captured, etc.

13. **DATE-OF-OPERATION: Field Length XXXXXX**

This is the designated date in which a planned operation is to occur in accordance with the operation plan.

14. **DATE-OF-REPORT: Field Length XXXXXX**

This data element is used to denote the date that a given report is submitted.

15. **DATE-OF-RECEIPT: Field Length XXXXXX**

This data element denotes the date on which a given report is received by the Command.

16. **DEPARTING-COMMAND-RUC: Field Length XXXXX**

This data element is used to denote the reporting unit code of the departing command of a departing individual.

17. **ESTIMATED-DATE-OF-ARRIVAL: Field Length XXXXXX**

This data element is used to denote the date on which a replacement is expected to report to a given command.

18. **ESTIMATED-DATE-OF-DEPARTURE: Field Length XXXXXX**

This data element is used to denote the date in which a replacement is expected to depart from a given a command.

19. **EXPECTED-CASUALTIES: Field Length XXXXX**

This data element is used to estimate the number of casualties expected in an upcoming operation.

20. **EXPIRATION-OF-ACTIVE-SERVICE(EAS): Field Length XXXXXX**

This is a six digit number in format of YYMMDD. It is the planned termination of active service date for an individual.

21. **FOREIGN-LANGUAGES: Field Length XX**

This a two digit code as specified in MCO P1080.20. It indicates the languages in which the individual is proficient.

22. **GRADE: Field Length XXX**

This data element identifies the present grade of an individual marine.

23. **LICENSES-GOVERNMENT: Field Length X**

This is a one character code which identifies each license to the individual by the military or federal government.

24. **LINE-NUMBER: Field Length XXXX**

This data element is used when assigning replacement personnel to a unit in accordance with a table of organization for a particular reporting unit.

25. **MATRIX-NAME: Field Length XXXXXXXXXXX**

THis data element is used to give a specific name to a particular matrix that can be used in several situations.

26. **MILITARY-OCCUPATIONAL-SPECIALTY(MOS): Field Length XXXXXXXXXXXXXXX**

This code contains the billet MOS, and the primary, 1st and 2nd if applicable. Each code has a field of 4 numbers. The MOS is a numeric code to denote the military occupational skills and qualifications of the individual.

27. **NAME: Field Length XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX**

The field length is 32 characters containing the information in the following sequence: last name and suffix, first name and middle initial(s). The source document for verification is the enlistment contract, record of induction or appointment acceptance record.

28. **MONITORED-COMMAND-CODE: Field Length: XXX**

This is a code assigned for identification and control purposes to a commander, unit, activity, or an individual billet to which assignment of individuals is controlled by the Commandant of the Marine Corps.

29. **ON-HAND-STRENGTH: Field Length: XXXXXX**

This is the number of personnel that are actually available for use by a commander.

30. **OPERATION-DURATION: Field Length XXXXXX**

This data element denotes the length of a scheduled operation in accordance with the operation plan. This data is useful in projecting the personnel requirements.

31. **OVERSEAS-CONTROL-DATE: Field Length XXXXXX**

It is the last date the marine arrived in the continental United States from an overseas assignment.

32. **PRIORITY: Field Length XX**

This data element is used to denote the priority of the replacement personnel in reference to the needs of the reporting unit commander.

33. **RACE/SEX: Field Length XX**

This data element identifies an individual's race and sex.

34. **REPORT-DATE: Field Length XXXXXX**

This is the actual date on which a report was submitted.

35. **REPORT-NUMBER: Field Length XXXXXX**

This data element denotes the report number of the permanent change of station orders sent to an individual.

36. **REPORTING-COMMAND: Field Length XXXXX**

This data element is used to denote the RUC of the command in which an individual is reporting.

37. **REPORTING-OFFICER: Field Length XXXXXXXXXXXXXXXXXXXXXXXXXXXXX**

This is the officer that has delegation authority from the commanding officer to submit a given report.

38. **REQUIREMENT-DATE: Field Length XXXXXX**

This is the date in which the number of replacements requested in reference to projected requirements must be made available to the Command Reporting Unit Commander.

39. **ROTATION-TOUR-DATE: Field Length XXXXXX**

This is the data a marine is scheduled to return to the Continental United States from an overseas assignment.

40. **SECURITY-INVESTIGATION/CLEARANCE: Field Length XXXXXXXX**

This is a one character that denotes the type of investigation conducted, one character denotes the level of security authorized, and six characters denotes the date the investigation was completed.

41. **SERVICE-SCHOOLS: Field Length XXXXX**

This element identifies the formal service school which the marine has completed and the year of completion. The subelements consist of service school with 3 characters and year of completion with 2 characters.

42. **SOCIAL-SECURITY-NUMBER: Field Length XXXXXXXXX**

This is a unique code with a field length of 10 numbers. This is a member's personal identifier.

43. **SPECIAL-QUALIFICATIONS: Field Length XXXXXXX**

This data element identifies categories of special qualifications and the date of qualification. Special qualifications has 2 characters, and date of qualification is 6 numeric characters.

44. TABLE-OF-ORGANIZATION-NUMBER: Field Length XXXX

This data element is used to denote the table of organization number used to assign replacement personnel.

45. TIME-OF-REPORT: Field Length XXXX

This data element is a time stamp applied to a report upon receipt of of transmittal.

46. TOTAL-MOS: Field Length XXXXXX

This data element denotes the total number of skilled personnel in a particular military occupational specialty.

47. TOTAL-GRADE: Field Length XXXXXX

This data element denotes the breakdown of personnel by grade. This data is used to determine shortages or overages by grade.

DATA STRUCTURE CHART

DATA STRUCTURE	FIELD LENGTH
Reporting Unit (RU) Status=	
+Reporting-Unit-Code	06
+Daily-Unit-Losses	06
+Daily-Unit-Gains	06
+Daily-MIA-Count	06
+Daily-Casualty-Count	06
+Daily-Strength-(Grade-Skill-Matrix)	65
Projected-Requirements=	
+Command-Reporting-Unit-Code(CRUC)	06
+Command-Name	15
+Grade-Skill-Matrix	65
+Requirement-Date	06
+Reporting-Unit-Code	06
+Report-Date	06
+Reporting-Officer	32
+Time-of-Report	05
+Time-of-Receipt	05
Command-Unit-(CU)-Status=	
+Command-Reporting-Unit-Code	06
+Command-Name	15
+Report-Date	06
+On-hand-Strength	05
+Strength-(Grade-Skill-Matrix)	65
+Reporting-Unit-Status	06
+Projected-Requirements	06
+Reporting-Officer	32
Operation-Plans=	
+Command-Name	06

```
  +MCC                                    03
  +Report-Date                            06
  +Date-of-Operation                      06
  +Required-Unit-Names                    08
  +Operation-Duration                     08
  +Expected-Casualties                    05
  +Reporting-Officer                      32

Current-Status=

  +Command-Reporting-Unit-Code            05
  +MCC                                    03
  +Command-Name                           15
  +Report-Date                            06
  +On-Hand-Strength(Grade-Skill-Matrix)   65
  +Daily-Average-Casualties               05
  +Daily-Average-MIAs                     05

Grade-Skill-Matrix=

  +Matrix-Name                            12
  +Grade                                  03
  +MOS                                    04
  +Total-MOS                              05
  +Total-Grade                            05
  +Report-DAte                            06
  +Time-of-Report                         04
  +Time-of-Receipt                        04
  +RUC/CRUC                               05
  +Reporting-Officer                      21

Assignment-Priority=

  +Command-Reporting-Unit-Code            06
  +RUC                                    05
  +Grade-Skill-Matrix                     65
  +Priority                               02
  +Reporting-Officer                      32
```

PCS-Orders-Report=

+Command-Reporting-Unit-Code	06
+Name	32
+Grade	03
+MOS	04
+Social-Security-Number (SSN)	09
+Estimated-Date-of-Departure	06
+Estimated-Date-of-Arrival	06
+Departing-Command-RUC	05
+Reporting-Command-RUC	05
+Report-Date	08
+Date-of-Receipt	08
+Authorizing-Authority (RUC)	06

Replacements=

+CRUC	06
+NAMe	32
+Grade	03
+MOS	04
+SSN	09
+Date-of-Departure	08

Assigned-Replacements=

+RUC	05
+Replacements	61
+Date-of-Arrival	08
+Line-Number	04
+T/O Number	04

Replacement-Request=

+Manpower-Pool-CRUC	05
+Grade-Skill-Matrix	65

Order-Verification=

+Report-Number	06
+PCS-order-Report	68
+Time-of-Transmit	04
+Date-of-Report	06

APPENDIX B
PROCESS DESCRIPTIONS

1. Report Personnel Status

It is during this process that the reporting unit commanders prepare the various required and requested personnel status reports. These reports provide the intermediate level commanders with a detailed picture of the status of the human resources at each of his subordinate commands at a given instant in time. The reporting units will also make the necessary unit diary entries during this process to reflect any changes in the status of individuals within the units. Some examples of reports prepared during this process are: Periodic Personnel Reports, Field Casualty Reports, Daily Personnel Summary Reports, etc.

2. Project Command Requirements

During this process, the intermediate level commander will utilize data from various reporting unit reports, MMS reports, and operational requirements from the G-3 to project the manpower requirements of the command.

3. Prepare Replacement Report

During this process, the intermediate level commander will prepare a replacement requisition which will be a by grade/mos matrix detailing the overall replacement needs of the command. The commander will utilize both projected requirements and current requirements as aids in the preparation of this report.

4. Determine Automatic Replacements

During this process, the manpower pools will project the replacement requirements of subordinate commands utilizing data derived from the manpower management system and HQMC. No reports are required from the subordinate commands to complete this process.

5. **Allocate Total Replacements**

The manpower pools will attempt to allocate replacements to fill both automatic and requistioned replacement requirements. Replacements will be allocated to fill by grade and military occupational specialty requirements of subordinate commands from personnel available at each administrative command level. The pools will also notify HQMC of these allocations in order to assist them in the preparation of PCS orders.

6. **Prepare Automatic Order Writing Process**

This is the automatic order writing process which takes place at HQMC. Orders will be written for personnel who are allocated by the manpower pools to serve as replacements in subordinate commands. HQMC will utilize data that it receives from the mobilization pools, and the manpower management system to prepare these orders. Once these orders have been prepared, HQMC will submit a PCS orders listing to the mobilization pool and the intermediate level commands via unit diary entries into the field master files of the JUMPS/MMS system.

7. **Prepare Transportation Request**

This process takes place at both the mobilization pools and at the intermediate commands. During this process, the sealift/airlift requirements are studied and a request for the desired services are submitted to the service branch tasked to provide such services.

8. **Assign Personnel**

During this process, the intermediate level commanders will assign reporting replacement personnel to their various subordinate reporting units. They will assign these personnel based on their judgement of the severity of the needs of each subordinate unit. Unit diary entries will also be made at this time to reflect the reporting unit code of each assigned individual and to verify the PCS orders report prepared during the AOFP.

9. **Join Replacements**

During this process, the reporting units will join an individual to that unit by making the proper unit diary entries and adding the individual to the Commanders' Unit Diary Data Base(CUDDB).

10. **Develop Manpower Plan**

During this process, HQMC will develop long range manpower plans based on information retrieved from manpower policy statements, mission statements, and data retrieved from manpower models provided by the manpower management system. These plans will serve as the basis for the development of personnel procurement plans. These procurements will eventually serve as personnel replacements.

APPENDIX C
ABBREVIATIONS

ADP - Automated Data Processing

ADPE - Automatic Data Processing Equipment

ADPE-FMF - Automatic Data Processing Equipment for the Fleet Marine Force

ADPE-FMF-MGTPLAN - Automatic Data Processing Equipment for Fleet Marine Force Management Plan

AOA - Amphibious Operation Area

AOWP - Automatic Order Writing Process

AUTODIN - Automatic Digital Information Network

AIS - Automated Information System

CMC - Commandant of the Marine Corps

CUDDB - Commanders Unit Diary Data Base

CRUC - Command Reporting Unit Command

DDN - Defense Data Network

DFASC - Deployed Force Automated Services Center

FASC - Force Automated Services Center

FMF - Field Master File

FMF - Fleet Marine Force

FMR - Field Master Record

FTP - File Transfer Protocol

HQMC - Headquarters Marine Corps

HIU - Host Interface Unit

JUMPS/MMS - Joint Uniform Military Pay System/Manpower Management System

LCM - Life Cycle Management

MAB - Marine Amphibious Brigade

MAF - Marine Amphibious Force

MAGTF - Marine Air Ground Task Force

MAU - Marine Amphibious Unit

MCC - Monitored Command Code

MCCDPA - Marine Corps Central Design and Programming Activity

MENS - Mission Element Need Statement

MCFC - Marine Corps Finance Center

MOS - Military Occupational Specialty

MMS - Manpower Management System

NTS - Naval Telecommunications System

PRIM - Personnel Reporting Instructions Manual

PRNET - Packet Radio Network

PRU - Packet Radio Unit

PCS - Permanent Change of Station

RASC - Regional Automated Services Center

REAL-FAMMIS - Real Time Finance and Manpower Management Information System

RUC - Reporting Unit Command

SDPI - Satellite Data Processing Installation

SIU - Speech Interface Units

SMTP - Simple Mail Transfer Protocol

T/O - Table of Organization

TIU - Terminal Interface Unit

UD - Unit Diary

UTR - Unit Transaction Register

APPENDIX D
DEFINITIONS

1. Ad-Hoc Reports - On demand Reports a command receives from the local SDPI, also called Class III Reports.

2. Automatic Orders Writing Process - PCS orders Reports provided to a major command providing orders for personnel in that command and information on personnel en route. Permits Headquarters Marine Corps to forward permanent change of station orders via the JUMPS/MMS.

3. Command Reporting Unit Code - The Reporting Unit Code of the senior command within a monitored command code that has the authority to issue PCS orders.

4. Ccmmanders Unit Diary Data BAse - This is the abbreviated copy of the Field Master File from which commanders can draw data. Each commander is provided an initial CUDDB diskett upon delivery of the UD application. The CUDDB will exist solely for the use of local commanders and will be responsive to their needs.

5. Field Master File - The field data base contains only those data elements required for management at those locations. The information within those data elements is identical, however, to that on the Central Master File.

6. Intermediate Command - Any echelon other than Headquarters which exercises administrative supervision over reporting units. Examples are regiments, divisions, groups, wings, bases, stations, and other activities where several reporting units exist within a command.

7. Joint Uniform Military Pay System/Manpower Management System (JUMPS/MMS) - An integrated system of standard manual and automated pay and personnel reporting procedures that establishes computer records and maintains accurate military personnel and pay data in these records.

8. JUMPS/MMS Central Master File - A computer record for each individual marine maintained at the Marine Corps Central Data Processing ACtivity, Kansas City, Mo. It is similiar to SDPI processing but it includes pay data on each individual marine.

9. Manpower Models - Computerized processes which take the decisicn logic for a particular manpower management problem and uses that logic to achieve the optimum solution.

10. Monitored Command Code - A code assigned for identification and control purposes to a command, unit, activity or an individual billet to which assignment of individuals is controlled by the Commandant of the Marine Corps.

11. Reporting Unit - An administrative activity which is required to accomplish personnel reporting, through unit diary submission, for all personnel assigned to that activity.

12. Reporting Unit Code - A code assigned to identify a unit, activity or subunit. RUC's are also assigned to identify echelons of commands which may not submit unit diaries, for example, division, brigade, regiment, aircraft wing and aircraft group.

13. Satellite Data Processing Installation (SDPI) - A data processing installation to which personnel reporting jurisdiction has been delegated by the Commandant of the Marine Corps.

14. Unit Diary The basic source document of JUMPS/MMS and is used to report personnel gains and losses, establish information and change, delete or correct previously reported information based on day-to-day occurrences.

15. Unit Personnel Reporting - Unit personnel reporting is normally performed at the lowest administrative echelon capable of self administration such as battalion, squadron, marine barracks, marine detachments and inspector - instructor levels.

16. Unit Transaction Register- Provides the reporting unit with the means to monitor the status of information reported on the unit diary, items entered from HQMC, and entries machine generated by the computer system. It is prepared to assist the reporting unit commander in discharging responsibilities for accurate and timely reporting of information into the JUMPS/MMS by being informed of all reported actions which affect members of the unit.

LIST OF REFERENCES

1. Tr-74-1582-M6, Marine Integrated Personnel System Concept and Design, Informatics, Inc., 31 May 74.

2. Richardson, R., interview held at Defense Communications Agency Office, McClean, Virginia, Nov 1984.

3. REAL FAMMIS Development Team, Review of Requirements for REAL FAMMIS Deployed AIS Support To MAGTFS, 23 September 1983.

4. Borklund, C.W., "Military Communications-The what is much tougher than the how," Government Executive, 1976.

5. TR-74-1582-M4, Marine Integrated Personnel System Concept and Design, Informatics, Inc., Jan 74.

6. MCO P5230.10, Automatic Data Processing Equipment for the Fleet Marine Force Management Plan (ADPE-FMF MGTPLAN). Commandant of the Marine Corps, 16 June 1983.

7. ACS - 1: JLH: sof 1080, Class I Automated Information Systems Support for Deployable Force Automated Service Centers, First Service Support Group FMFPAC, 12 October 1982.

8. FMFM 3-1, Command and Staff Action, FMF, Marine Corps Development and Education Command, 22 AUG 82.

9. Danner, D., interview held at Headquarters Marine Corps, Ideamatics, Inc., Washington DC, Nov 1984.

10. Clark, M., interview held at Headquarters Marine Corps, MPI-40, Washington DC, Nov 1984.

11. FMFM 1-1 (Draft), Operational Functions of the G-1/S-1. Marine Corps Development and Education Command, 12 November 1980.

12. Lott, J., interview held at Headquarters Marine Corps, MPI-40, Washington DC, Nov 1984.

13. MCO P1080.35D, Personnel Reporting Instructions Manual (PRIM). Commandant of the Marine Corps, 6 September 1984.

14. Burnett, P., interview held at Headquarters Marine Corps, Code CCT, Washington DC, Nov 1984.

15. MCO P3040.4, Marine Corps Casualty Procedures Manual (MARCORCAS PROCMAN). Commandant of the Marine Corps, 29 September 1984.

16. Defense Communications Agency, Defense Data Network, January 1984.

17. Martin, James, Design and Strategy for distributed data processing, Prentice-Hall, Inc., 1981.

18. Defense Advanced Research Projects Agency, Packet Radio Network, July 1983.

19. Defense Communcations Agency, Defense Data Network Subscriber Interface Guide, July 1983.

20. Defense Advanced Research Projects Agency, Joint Army/DARPA Distributed Communications and Processing Experiment, November 1983.

21. Cone, D., phone interview, Research Engineer, Packet Radio Project, SRI International, 15 Mar 85.

22. Wegl, C., phone interview, DDN users group, McClean, Va., Feb. 85.

23. Defense Communications Agency, Submission of Telecommunications Service Requests, June 83.

24. Network Information Center, SRI International, Internet Protocol Implementation Guide, August 1982.

25. Frankle, M., interview held at Stanford Research Institute, DARPA, 12 Feb 1985.

26. Defense Advanced Research Projects Agency, Distributed, Survivable Command and Control/Army Data Distribution System/Packet Radio Testbed, April 1983.

BIBLIOGRAPHY

Adams, David R., Mills, Harlan D., Powers, M.J., Computer Info Systems Development: Analysis and Design, South Western Publishing Company, 1984.

Defense Communications Agency, Defense Data Network Plan, January 1982 revised May 1982.

Department of Defense, Military Standard Internet Protocol, 12 August 1983.

FMFM 10-1, Communications, Marine Corps Development Education Center, 9 Oct 1980.

Gane, Chris, and Sarson, Trish, Structured Systems Analysis: Tools and Techniques, Prentice-Hall, Inc., 1979.

Leiner, Barry, Klein, T., Graff, B., "Data Distribution in a Tactical Environment," Signal, Nov 1983.

Katzan, Harry, Jr., Local Area Networks, A Manager's Guide, Carnegie Press, Inc., 1983.

MCO P5231.1, Life Cycle Management for Automated Information Systems, Commandant of the Marine Corps, 9 Aug 1983.

MCO P7220.40 Joint Uniform Pay System Field Procedures Manual (III), Commandant of the Marine Corps, 11 Jan 82.

SRI International, Distributed, Survivable Command and Control/Army Data Distribution System/Packet Radio Testbed, Final Technical Report, August 1984.

SRI International, Command, Control, and Communications Testbed for Strategic Air Command, December 1983.

Turabian, Kate L., A Manual for Writers of Term Papers, Theses, and Dissertations, The University of Chicago Press, 1973.

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